

UNDERSTANDING THE ROLE OF PERSONALITY TRAITS IN DEFINING LEARNING STYLES AMONG THE MEDICAL STUDENTS - A CROSS-SECTIONAL STUDY

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Abstract

Background: Educational outcomes among medical students consistently rely on diversified learning patterns and information management. Learning styles describe preferred approaches towards information acquisition, processing, dissemination, and retention, whereas personality traits stimulate cognitive and behavioral patterns. This study examines the relationship between learning styles and personality traits among medical students in medical colleges and universities in Pakistan.

Objective: To study the relationship between learning styles and personality traits among undergraduate medical students.

Methodology: This research study employed a cross-sectional design, with a sample of 382 MBBS students selected through stratified random sampling at CMH Kharian Medical College. Learning styles were assessed using the validated VARK questionnaire, and personality traits were measured using a standardized instrument measured on Likert scale. SPSS is used to analyze the linkage between the learning styles defined by personality traits

Results: Kinesthetic learning was the predominant preference (63.87%), followed by auditory (26.70%), while visual and read/write styles were least common (4.71% each). Most participants demonstrated moderate extroversion (59.42%), and 37.96% exhibited balanced personality traits. No significant association was found between learning styles and personality traits ($p = 0.126$). Learning styles were not significantly associated with gender ($p = 0.097$) or academic year ($p = 0.531$). In contrast, personality traits showed significant associations with gender ($p = 0.0004$) and academic year ($p = 0.017$).

Conclusion: Learning style preferences appear distinct from personality traits in this cohort, challenging assumptions of a direct linkage. The prominence of kinesthetic learning underscores the value of active, practice-oriented teaching approaches. Given the significant variation in personality traits across gender and academic progression, medical curricula should prioritize adaptable, multimodal instructional strategies over fixed learning style frameworks to better accommodate learner diversity and optimize educational outcomes.

Introduction & Literature Review

In modern medicine education, the concept of individual differences in learning has become a major priority in upgrading academic performance, outcomes, and teaching strategies.

Students in the medical field must take in vast amounts of theoretical information and acquire clinical skills, competencies, and aptitude. Therefore, it is essential to adopt effective and personalized learning methods. Personality traits

and learning styles have been recognized among the determinants of learning behavior as they impact on the way students process, store, and use information.

Medical education is a complex field that demands learners to assimilate a plethora of scientific information and at the same time cultivate clinical reasoning, psychomotor skills, ethical judgment and interpersonal competence. Due to such complexity, students varied significantly in their approaches toward learning activities and their reactions to learning difficulties. Educational psychology has always focused on the fact that these differences are determined by both the learning preferences and the personality traits which may affect the quality of learning experiences and educational results (Cassidy, 2004).

Learning style is defined as the favorable manner in which the learner acquires, arranges and remembers information. Among these numerous theoretical frameworks the VARK framework created by Fleming can be considered as one of the most practical and the most common ones used in the research related to medical education (Fleming, 2006).

VARK model categorizes learning into visual, auditory, read/write and kinesthetic. Laboratory work, simulation, bedside instruction and training of the procedure is common in medical education, which tends to support the use of kinesthetic and multimodal methods (Lujan and DiCarlo, 2006; Baykan and Nacar, 2007). A number of studies within the group of medical students revealed that the styles of kinesthetic and auditory orientation are mainly predominant, especially during the clinical years (Javaeed et al., 2020; Fahim et al., 2021). This tendency is explicable because medical students are becoming more and more reliant on clinical demonstrations, exposure in wards, OSCE training, and case discussions on the basis of real-life cases.

Personality traits, in turn, are long-lasting behavioral and emotional patterns, which influence how individuals relate to their environment. The initial study by Costa and McCrae (1992) emphasized the relevance of stable dimensions of personality in forecasting

performance, social interaction and psychological adaptation. Personality affects teamwork, leadership, tolerance to stress, and coping with professional expectations in medical students (Tyssen et al., 2007).

Studies indicated that extroverted students can be successful in a collaborative and discussion-based learning style, whereas introverted students might be more successful in reflective or independent learning methods (Abouzeid et al., 2021). Nevertheless, there is a mixed-literature on whether personality traits are actual predictors of particular learning style preferences. There are some studies that indicate weak associations, and some studies indicate that the relationship is indirect and mediated by academic context (Sohrabi, Bigdeli and Nadjafi, 2023; Ismail and Althabawi, 2024).

In Pakistan, there is minimal research that has been carried out to study the relationship between learning styles and personality traits among undergraduate medical students, especially across all academic years. CMH Kharian Medical College offers a one-of-its-kind environment to study this relationship since it encompasses students of different levels of preclinical and clinical education in a structured learning process.

Research Objectives

To seek the relationship between learning styles and personality traits of undergraduate medical students in CMH Kharian Medical College.

Research Questions

- What are the most common undergraduate medical student learning styles?
- Do personality traits and learning styles have a statistically significant relationship?
- Are there gender and academic year differences in learning styles and personality traits?

Rationale of the Study

The knowledge of learning styles in relation to personality traits may assist curriculum planners in developing instruction strategies based on the students. It may also inform mentoring systems,

enhance the effectiveness of group learning, and enhance student wellness support services.

Significance of the Study

Knowledge of the association between learning styles and personality is critical in guiding evidence-based curriculum design and teaching. The observations of this study can be used to help implement malleable, multimodal teaching models that resonate with varied learning requirements thus improving academic success and student involvement. Such evidence is especially useful in resource-constrained educational environments, where the efficiency of teaching does not necessarily have to be improved through major structural adjustments.

Research Gap

The current paper helps fill a significant gap in the literature by exploring the relationship between personality characteristics and learning styles in a Pakistani medical education environment. But there are some limitations that need to be taken into account. Cross-sectional design does not allow causal inferences and data collected using self-reported instruments can be subject to bias in response. Also, the results of one institution might not be generalizable to other contexts.

Methodology

Study Design

This study was conducted as a cross-sectional analytical study to determine the association between learning styles and personality traits among undergraduate medical students. The cross-sectional design was deemed most suitable due to its ability to measure exposure and outcome variables at the same time over a specific time frame. The exposure variables in the current study were: gender and academic year, whereas the main variables of analysis were learning style preferences and personality traits. Setting and Duration of the study.

The research was conducted in CMH Kharian Medical College, Kharian, Pakistan. The process of data collection was done within a period of six months between February 2025 and July 2025. This was an appropriate time to make sure that

students of all academic years participated, to be able to remind them to participate, and to complete data cleaning and analysis.

Population & Sample

The study sample was all undergraduate MBBS students from the first year to the final year of CMH Kharian Medical College at the time of study. The sample of all five years of study enabled comparison of learning preferences and personality characteristics at various levels of medical education, between preclinical and senior clinical years.

Students of 1st, 2nd, 3rd, 4th, and final year of MBBS who voluntarily consented to take part in the study and supplied informed electronic consent were included in the study.

The study excluded the following:

- House officers
- Paramedical staff
- Students that refused to participate.
- Students who did not provide informed consent

These were used as exclusions to ensure homogeneity of the sample of undergraduate studies.

Sample Size Calculation

The sample size was calculated using the single population proportion formula, which is widely used for cross-sectional studies:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

- **n** = required sample size
- **Z** = Z-score at 95% confidence level
- **p** = anticipated proportion
- **d** = margin of error

A prevalence of 50% was taken since there was no previous institutional estimate, and this gives the maximum sample size.

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

$$n = \frac{0.9604}{0.0025} = 384.16$$

Thus, the required sample size was approximately 384 students. The final sample analyzed had a sample size of 382 MBBS students after the

response feasibility and full availability of the questionnaire, due to statistical adequacy, which is quite near to the calculated figure.

A proportionate stratified random sampling technique was used to ensure fair representation from all academic years. The entire undergraduate MBBS population was divided into five strata based on year of study. A stratified sample was then chosen based on the student strength of the respective year. The final distribution was:

- 1st year = 76
- 2nd year = 79
- 3rd year = 91
- 4th year = 89
- Final year = 47

This approach reduced sampling bias and enhanced representativeness at all levels of academics.

Instrumentation & Scaling

Learning Styles Assessment - The VARK Questionnaire created by Fleming (2006) was used to determine the learning style preferences. VARK tool divides students into four sensory learning styles:

- Visual
- Auditory
- Read/Write
- Kinesthetic

All questions of the VARK questionnaire had four response options, each one of which is a representation of one of the modalities. The highest scored learning style was viewed as the preference.

Personality Traits Assessment - The measurement of personality traits was carried out with the help of a self-administered structured questionnaire that was rated with the help of a 5-point Likert scale, with the following scores:

- 0 = Never
- 1 = Rarely
- 2 = Sometimes
- 3 = Often
- 4 = Always

The maximum score used was 100 and the interpretation was done as follows:

- 80-100: Strongly extrovert and emotionally stable
- 60-79: Moderately extrovert, works well in teams
- 40-59: Balanced extrovert and introvert personality
- 20-39: Slightly introvert and emotionally unstable
- 0-19: Strongly introvert

Reliability Analysis

The internal consistency of the personality questionnaire was assessed using Cronbach's alpha coefficient.

The formula used was:

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2} \right)$$

Where:

- α = Cronbach's alpha
- k = number of items
- σ_i^2 = variance of each item
- σ_t^2 = total variance of the summed score

A value of Cronbach alpha of 0.717 was obtained, which means that the personality assessment tool has an acceptable level of internal consistency reliability.

Data Collection

The data were gathered using a soft-copy online questionnaire that was electronically administered to the students. The involvement was completely voluntary, and informed consent was taken prior to accessing the questionnaire. The online approach was chosen due to the fact that it enabled:

- convenient access to students at every level of academics
- better response management
- time flexibility
- efficient data entry
- minimization of hand-coded errors.

Data Analysis

The data obtained were input and analyzed with IBM SPSS Statistics version 26.

Descriptive Statistics

The demographic characteristics and the frequency distribution of the learning styles and personality traits were summarized using descriptive statistics.

- Frequencies and percentages were used to indicate categorical variables.
- Continuous variables, e.g., age, were presented in the form of mean and standard deviation.

The mean age formula used was:

$$\bar{x} = \frac{\sum x}{n}$$

Standard deviation formula:

$$SD = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

The average age of participants was calculated as **21 ± 1.68 years**.

Inferential Statistics

To assess associations between categorical variables, the **Chi-square test** was applied.

Formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where:

- O = observed frequency
- E = expected frequency

Table 1: DEMOGRAPHICS OF STUDY POPULATION:

	Categories	n (%)
Gender	Female	259 (67.8%)
	Male	123 (32.2%)
Year of study	1st	76 (19.9%)
	2nd	79 (20.7%)
	3rd	91 (23.8%)
	4th	89 (23.3%)
	5th	47 (12.3%)

The pie chart shows the frequency of VARK learning preferences. The kinesthetic type of learning was predominant (n = 244, 63.87%), which means that there was a strong inclination to the practical and experiential approach to

This test was used for:

- learning styles vs personality traits
- gender vs learning styles
- gender vs personality traits
- year vs learning styles
- year vs personality traits

For comparison of means between two groups, the **independent sample t-test** was used:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

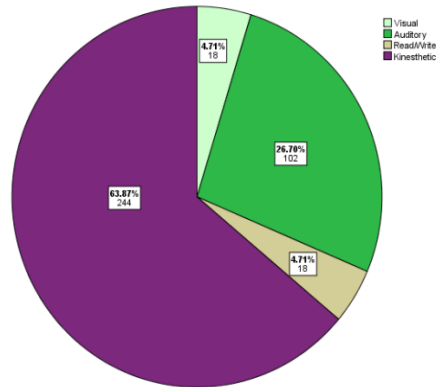
A **p-value less than 0.05** was considered statistically significant.

Results

A total of 382 MBBS students participated in the study. The majority of 259 participants (67.8 percent) were female and 123 participants (32.2 percent) were male. The academic year distribution was representative of all years with 76 first-year students, 79 students in the second year, 91 students in the third year, 89 students in the fourth year and 47 final-year students. The average age was 21.00 ± 1.68 years which was a typical undergraduate student population of medicine.

learning. Auditory learners accounted for 102 students (26.7%), while both visual and read/write styles were equally represented by 18 students each (4.71%).

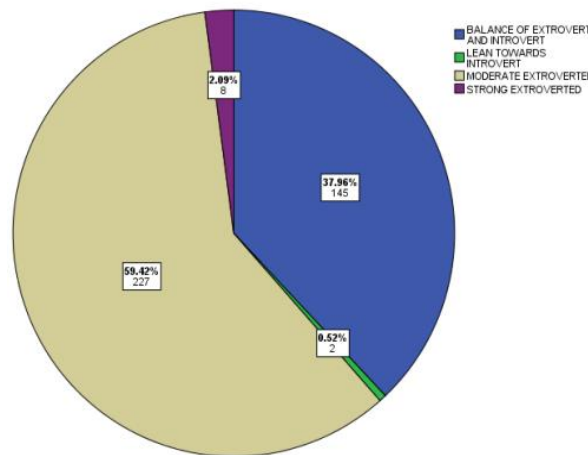
Fig i: Frequency of learning styles



The personality distribution showed that moderate extroversion (n = 227, 59.42%), balanced extrovert-introvert personality (n = 145, 37.96%), were the most often ones. There were

only 2 students who gave a tendency towards introversion with 8 students strongly extroverted indicating that most of them had socially adaptive personalities.

Fig ii: Frequency of Personality Traits



This table illustrates the distribution of VARK learning styles across different personality categories. The most common preference in all personality groups was the kinesthetic learning, especially moderate extroverts (n = 145) and

balanced (n = 92) students. Although these numbers are in these directions, the chi-square revealed no statistically significant relationship (p = 0.126).

Table 2: Association between learning styles and personality traits

Personality Interpretation	Categories	Learning styles (VARK)				p-value
		Visual	Auditory	Read/write	Kinesthetics	
						0.126

Balance of extrovert and introvert	8 (2.09%)	36 (9.42%)	9 (2.36%)	92 (24.08%)
Lean towards introvert	1 (0.26%)	0 (0%)	0 (0%)	1 (0.26%)
Moderately extroverted	9 (2.36%)	65 (17.02%)	8 (2.09%)	145 (37.96%)
Strongly extroverted	0 (0%)	1 (0.26%)	1 (0.26%)	6 (1.57%)

Both female and male students predominantly preferred kinesthetic learning. Among the female students, there were 176 students who favored the kinesthetic learning style before 61 auditory

students. In men there were 68 kinesthetic and 41 auditory. The correlation between gender and learning style could not be statistically significant ($p = 0.097$).

Table 3: Association between gender and learning styles

		LEARNING STYLES				p-value
Gender	Category	Visual	Auditory	Read/Write	Kinesthetics	0.097
	Female	12(3.14%)	61(15.97%)	10(2.62%)	176(46.07%)	
	Male	6(1.57%)	41(10.73%)	8(2.09%)	68(17.80%)	

The most common personality characteristic among the females ($n = 154$) and males ($n = 73$) was moderate extroversion. It is noteworthy that

all the highly extroverted participants ($n = 8$) were males. The correlation of gender and personality characteristics was significant ($p = 0.0004$).

Table 4: Association between gender and personality traits

		Personality Traits				p-value
Gender		Balance of extrovert and introvert	Lean towards introvert	Moderately extrovert	Strongly extrovert	0.0004
	Female	104(27.23%)	1(0.26%)	154(40.31%)	0 (0%)	
	Male	41(10.73%)	1(0.26%)	73(19.11%)	8(2.09%)	

The most prevalent type of learning was kinesthetic learning, and the highest number was in the third year ($n = 63$). Auditory style was always

placed second in classes. The statistical analysis did not find a significant correlation between year of study and learning style ($p = 0.531$).

Table 5: Association between year of study and learning styles

Year of study	Learning styles				p-value
	Visual	Auditory	Read/Write	Kinesthetics	
1st	3(0.79%)	26(6.81%)	3(0.79%)	44(11.52%)	0.531
2nd	6(1.57%)	19(4.97%)	7(1.83%)	47(12.30%)	
3rd	4(1.05%)	22(5.76%)	2(0.52%)	63(16.49%)	
4th	4(1.05%)	25(6.54%)	3(0.79%)	57(14.92%)	
5th	1(0.26%)	10(2.62%)	3(0.79%)	33(8.64%)	

The most popular personality trait was moderate extroversion in all academic years, with the highest frequency in third (n = 66) and fourth (n = 45)

year. The correlation between the year of study and personality traits was significant (p = 0.017).

Table 6: Association between year of study and personality traits

Year of study	Personality Traits				p-value
	BALANCE OF EXTROVERT AND INTROVERT	LEAN TOWARDS INTROVERT	MODERATE EXTROVERT	STRONG EXTROVERT	
1st	30(7.85%)	0 (%)	44(11.52%)	2(0.52%)	0.017
2nd	37(9.69%)	2(0.52%)	38(9.95%)	2(0.52%)	
3rd	24(6.28%)	0 (%)	66(17.28%)	1(0.26%)	
4th	41(10.73%)	0 (%)	45(11.78%)	3(0.79%)	
5th	13(3.40%)	0 (%)	34(8.90%)	0 (%)	

Discussion

The current cross-sectional analytical research offers an in-depth insight into the difference in the choice of the learning style and personality traits in the undergraduate medical students at CMH Kharian Medical college and whether the constructs exhibit any quantifiable relationship. The results are especially applicable to the area of competency-based medical education, where learner-centered instructional methods gain more and more popularity.

The kinesthetic learning style was overwhelmingly predominant, as almost two-thirds of respondents indicated. This is not a revelation when considered in the context of medical training where anatomy dissection, laboratory practice, clinical demonstrations, bedside teaching, OSCE training, and simulation-based training are the norm. This learning exposure would naturally support experiential and action-oriented learning behaviors. The present finding is aligned with the previous studies on the topic by Javaeed et al.

(2020) in Azad Kashmir, who also reported that the prevalence of the kinesthetic preference is also very high among undergraduate medical students. Fahim et al. (2021) and Lujan and DiCarlo (2006) also noted similar results, as both studies have found that medical and dental students tend to learn best in a setting where they can actively participate, demonstrate, and apply their learning. The above high proportion of auditory learners as the second most common group could be due to the conventional pattern of teaching undergraduate MBBS in Pakistan where lectures, tutorials, viva sessions, and case discussions still constitute significant elements of the curriculum. Such kinesthetic and auditory dominance would indicate that the interactive teaching methods of combining a verbal explanation with a practical reinforcement would best suit the learning of students.

As far as the personality is concerned, the fact that the majority of the students are moderately extroverted indicates that the majority of the participants will have a moderate ability to communicate, collaborate, and be socially flexible. Medical education is a collaboration, ward group leadership, peer and faculty communication, and subsequent engagement with patients and attendants. Such repeated exposures can either be attractive or develop extroverted and socially functional characteristics in the long run. Arain et al. (2021) also support this finding by stating that personality is a significant factor that affects perceived learning efficacy among medical students, especially when learning in a collaborative setting.

The current study includes the fact that personality traits and VARK learning styles did not show a statistically significant association ($p = 0.126$). Even though the difference between the numbers across categories existed, the lack of significance indicates that the preference in the learning style might not be directly influenced by the personality disposition factor itself. Rather, it can be more affected by the structure of the curriculum, the methods of teaching, and the previous school learning and the requirements of medical training as such. This observation is quite similar to that of Sohrabi, Bigdeli and Nadjafi

(2023), who also revealed that there is not much evidence to prove that there is a strong direct correlation between these variables among medical education learners.

One reason that this may not be associated is that personality traits are more psychological consistency whereas learning preferences can be more adaptable and situational. Indicatively, an introverted student can learn to use the kinesthetic learning strategies even when subjected to skills laboratories, demonstrations in wards, or procedural teaching. Equally, a student who is an extrovert might tend to base much of his read/write strategies on read/write strategies when preparing to take professional examinations. Thus, the learning preference and personality might have a moderating relationship in the educational setting.

Another finding of the current research was that there were no significant differences in gender and learning styles, and it implies that there are no significant differences in how male and female students study at this institution. Kinesthetic learning was the favorite among both groups, and then auditory learning. This is consistent with some other previous literature albeit Wehrwein, Lujan and DiCarlo (2007) found some gender differences in physiology students. The insignificance in the current research could be because the common needs in the MBBS curriculum bring similar learning adjustments in both genders.

Conversely, there was a statistically significant association between gender and personality traits ($p = 0.0004$). The female students showed more moderate extroversion and balanced characteristics and all strongly extroverted students in the sample were male. This observation is informed by the large-scale personality research like Costa, Terracciano and McCrae (2001) and Schmitt et al. (2008) that reported the presence of strong gender-based variations in various personality dimensions in cross-cultural setting. These differences can affect the communication styles, group task leadership, and stress approaches in medical education.

The other significant observation was that there was a significant association between academic

year and personality characteristics ($p = 0.017$). Moderate extroversion was more frequent among senior students, especially those in their third and fourth years. This could be the influence of gradual personality development by recurring academic and clinical exposure. Students in preclinical stages will gradually become more comfortable with interactions with faculty, peers, patients, and healthcare teams as they advance to clinical stages. The experiences can increase socially adaptive characteristics and professional confidence. The longitudinal research conducted by McManus, Keeling and Paice (2004) and Tyssen et al. (2007) also reinforces the belief that behavioral and emotional inclinations could be modified with time with regard to medical training.

It is also interesting that the correlation between year of study and learning style is not strong. Although there was a growing clinical exposure in later years, the dominance of kinesthetic learning was present in the first year, up to the final year. Such consistency implies that practical and experience-based learning is not just appreciated during clinical years but also in all years of the MBBS. It supports the necessity of vertically-profiled curricula in which practical instruction is implemented at the most initial levels.

Practical Implications

In terms of education, the evidence has been highly in favor of the growth of simulation based learning, case based pedagogy, clinical skill laboratories, bedside demonstrations, and problem based group work. Most students liked to learn by means of kinesthetic and auditory, which is why didactic lectures might not be enough to make the most of the interaction. Rather, the combination of explanation, demonstration, and practice, which can be blended, can lead to better results.

Implications of the personality findings also extend to the mentoring, peer learning and student wellness systems. Students who are balanced or slightly introverted might need other types of academic support and confidence-building activities as compared to those who are strongly extroverted. By being aware of these

differences, mentoring can be enhanced and stress levels can be minimized in the course of professional training.

Conclusion

The research concludes that the most popular educational preference of the MBBS students in CMH Kharian Medical College is the use of a kinesthetic learning style, and the most prevalent personality type is moderate extroversion. Despite the fact that the personality traits significantly differed depending on gender and academic year, there was no statistically significant correlation between personality traits and learning styles. These results highlight that although personality has a role in the diversity of students, applied and experiential learning is the universal choice in undergraduate medical education.

Recommendations

In light of the results of this study, it is suggested that there is a need to apply more and more student-centered and practice-oriented approaches to undergraduate medical teaching. Because the most prevalent style, namely, the kinesthetic, turned out to be the most prominent one, faculty members are supposed to pay closer attention to simulation sessions, bedside teaching, clinical demonstrations, anatomy practicals, OSCE-based training, as well as small-group procedural workshops. These approaches will probably be consistent with the natural learning preferences of most students and can enhance the retention of knowledge and clinical confidence.

Moreover, the strong gender and academic years difference in personality traits imply that mentorship and academic counseling programs ought to be individualized. Less socially expressive personalities can be helped by facilitating peer interaction, workshops on communication, and defined leadership experiences. To enhance generalizability and enable the possibility of regional comparison, future multicenter studies by including both public and private medical colleges in Pakistan should be carried out. Longitudinal studies would prove particularly useful in the process of learning whether personality traits and

learning preferences change during the preclinical-clinical transition.

Limitations

Despite the fact that this study has given valuable institutional evidence, some limitations are to be noted. To begin with, the research was carried out in one medical college, and this may not be representative of the rest of the institutions with different curricula and student populations. Second, a self-administered online questionnaire was used to collect data, which creates the potential of recall bias, social desirability bias, and selective response patterns.

Moreover, the cross-sectional design constrains the ability to cause interpretations, which implies that the existing links simply cannot determine whether personality affects learning style or the other way around. These variables were also not correlated with academic performance, examination scores, or stress outcomes, which might have given additional understanding of the educational value of the results. Lastly, the personality tool revealed a reasonable reliability; a more validated inventory, like the Big Five model, can provide more psychological insight in future research.

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