Personality and cognitive style differences among matriculation engineering and information technology students

Khairul A. Mastor & Abd H. Ismail

Universiti Kebangsaan Malaysia
Kuala Lumpur, Malaysia

ABSTRACT: Research currently indicates that personality traits are important factors to be considered in the decision-making process. Indeed, personality and the work or learning environments help to determine key desirable outcomes. In applying this to the area of educational choice, an assumption is made that the more suitable and appropriate the matching of one's personality with the selected academic major, the more likely it is that the student will be successful and committed. The present study argues that consistency and compatibility of personality is a fundamental aspect for academic majors like engineering and information technology. Another important aspect of the decision-making process in the selection of academic major is the student's cognitive suitability. A survey was undertaken of matriculating students and assessed utilising the *NEO Personality Inventory-Revised*. GEFT scores indicated that future engineering students were more likely to be categorised as field independent, while future information technology students were likely to be classified as field dependent learners. The study concludes by stating that students could be advised to choose courses based on the match between the cognitive style and the nature of the subjects.

INTRODUCTION

A review of the literature on academic major decision-making suggests that personality traits are important antecedents and are important aspects of the decision-making process. That very aspect is *suitability*: the matching of a person's personality with his/her chosen academic major or vocational preference. This suitability is associated with the person-environment-fit framework already pioneered by several researchers [1-3]. Holland has theorised that different personality types have different interests, competences and dispositions towards the work environment [2][4].

The congruence between personality and the work or learning environment determines certain desirable outcomes, such as the following:

- Success in the chosen vocation;
- Adaptation to the chosen vocation;
- Satisfaction with the chosen vocation;
- Commitment to the chosen vocation.

When this theory is extended to the area of educational choice, an assumption made is that the more suitable and appropriate the matching of one's personality with the selected academic major, the more likely it is that the student will be successful and committed. Studies in this context have been growing.

Kassebaum and Szenas, for example, studied medical-school seniors who completed the 1993 Graduation Questionnaire of the Association of American Medical Colleges and found that factors with the most influence on choice of specialty included those labelled *consistent with personality* [5].

For the present study, it is argued that consistency and compatibility of personality is essential not only for medical studies, but also for other academic majors like engineering and information technology.

Another important aspect of the decision-making process in the selection of academic major is the cognitive suitability of the person. The premise of the present study is that not only suitability of personality is important, but that cognitive style or style of perception and information processing also account for the same important necessities. Witkin, Moore, Goodenough and Cox, among others, proposed that cognitive style is a potential individual variable for the suitability of educational choice [6][7].

The issue of uncertainty about oneself has been reported in many studies and may also be related to the fact that many individuals do not know much about their own style of information processing, or whether this cognitive style is optimum to meet the cognitive demands of a particular field of study. Ignorance about one's own cognitive style may lead to unnecessary feelings of insecurity and a lack of confidence, and results in indecision over the choice of an academic major. Some students may end up choosing an academic major that is not suitable for their cognitive style.

Thus, individual characteristics, such as personality and cognitive style, are among the essential determinants in academic or career decision-making [8].

THEORETICAL FRAMEWORK

The theories of personality traits and field dependence-independence (FDI) cognitive style provide a theoretical framework for the study. The basic premise of this study is that the suitability of personality type and style of cognitive functioning is crucial in choosing a correct academic major.

Indeed, the literature suggests that personality traits and cognitive styles share certain similarities in that they both are stable and consistent over time [9][10]. The stability and consistency of personality traits make it possible for researchers to examine students' personality profiles in relation to their satisfaction with their choice of academic major, as well as their commitment to that choice.

A personality profile provides a picture of a student's personal characteristics, from which one can determine whether the student is suited to a particular field of studies. In addition, traits have been envisaged as having a relationship with affection [9]. Other traits have motivational tendencies, or provide basic templates of human behaviour [11]. In another study, Tokar and Subich showed that job satisfaction is associated with *conscientiousness*, a personality trait captured under a Big Five personality model [12].

In studying personality dimensions and academic choice, Rigley showed that persistence and personality are interrelated, but she did not explore the mechanism underlying that relationship [13]. Furthermore, she recommended that future studies should employ a more comprehensive model and instrumentation for studying relationships between personality and the process of selection of an academic major. Rigley suggested that *researchers may consider the employment of other measures of personality factors to obtain data in conjunction with the selection of academic majors and levels of persistence* [13]. Thus, in the present study, the authors employed a more comprehensive model of personality, namely the Big Five Model, as a guiding framework for personality dimensions [14][15].

An understanding of cognitive style then provides an initial assessment of one's capability of majoring in a particular field of studies. According to Witkin et al, cognitive style characterises a person's cognitive functioning and it continues to characterise a person in a very stable way over time [16]. Information about the style of processing information describes how well a person is able to adapt to the cognitive demands of a particular major.

For instance, studying engineering differs from studying humanities because of the nature and orientation of learning and teaching of these two fields, is rather different. Field-independent learners may be more suited to studying engineering or medicine, which require an analytical information-processing tendency. On the other hand, courses requiring global information processing tendencies, such as the arts and humanities, may be more appropriate for field-dependent individuals. Since both engineering and information technology fields possess similar nature of training, the authors seek to investigate, using quantitative data, whether there are any differences in their personality profiles and cognitive style orientation, despite the fields' equal professional status.

METHOD

The samples comprised 123 matriculation students from various matriculation centres in Malaysia: 63 students were those planning to study engineering, while 60 students aspired to major in information technology.

The instruments used were the translated version of the *NEO Personality Inventory-Revised* (NEO PI-R) [17][18]. Evidence suggests that the NEO PI-R is cross-culturally translatable and it has a respectable psychometric standing in the Malay version [19].

The reliability coefficients for *neuroticism*, *extraversion*, *openness*, *agreeableness* and *conscientiousness* are 0.89, 0.91, 0.69, 0.88 and 0.91, respectively. *Group Embedded Figures Test* (GEFT), a test of FDI cognitive style, were used to measure field dependence and field independence construct [10][20]. A correct answer for all pictorial problems in the GEFT is 18.00. A median is normally used as a point differentiating a field dependent individual (mean score GEFT < 13.00) or a field independent individual (mean score GEFT > 13.00).

Students were asked about their demographic data and their intended academic major in a separate questionnaire. This background information was then analysed in conjunction with the data on personality and GEFT scores. Analyses were conducted in terms of different intended major, ie information technology and engineering, looking at a comparison of their personality profiles and cognitive style orientation.

RESULTS

Table 1 shows the GEFT mean scores between students intending to study engineering and those intending to study information technology. There is a significant difference on the GEFT mean scores between these two group of students ($t = 2.470$, $p < 0.05$). Those students intending to study engineering have a higher mean score on GEFT than those intending to study information technology. Using the median score as the reference, future engineering students were more likely to be categorised as field independent, while future information technology students were likely to be classified as field dependent learners.

Table 1: GEFT mean scores of students intending to study Engineering and Information Technology.

Group	GEFT Mean scores (SD)	t (df = 121)
Engineering (n = 63)	13.49 (3.68)	2.470
Information Technology (n = 60)	11.65 (4.56)	

Table 2 indicates the personality trait mean raw scores differences between those students intending to study engineering and those seeking to study information technology. Both groups of students differ only on two personality facets, namely:

- O2: Openness to aesthetics;
- O4: Openness to actions.

Students intending to major in information technology are more open to aesthetic and actions than those planning to study engineering. Engineering students were slightly higher than information technology on agreeableness and conscientiousness. Information technology students were higher then engineering students on *neuroticism* and *extraversion*. However, these differences did not reach significance at the 0.05 level. In other words, prospective engineering and information technology students are quite similar to each other in term of their personalities.

Table 2: A comparison of personality traits between students intending to study engineering or information technology.

Domain	Information Technology	Engineering	t (df = 121)	p
Neuroticism	51.71 (10.95)	49.25 (9.13)	1.354	0.178
Extraversion	49.75 (12.50)	48.82 (8.47)	-0.495	0.621
Openness	51.40 (9.04)	47.82 (8.40)	2.276	0.025*
O2: Aesthetics	*50.88 (9.11)*	*46.06 (9.01)*	*2.950*	*0.004***
O4: Actions	*52.49 (10.98)*	*48.81 (8.76)*	*2.057*	*0.042**
Agreeableness	48.37 (8.57)	50.23 (9.62)	-1.128	0.262
Conscientiousness	47.17 (10.92)	49.82 (9.10)	-1.467	0.145

DISCUSSION

In this study, the authors utilised cognitive style chiefly as a useful indicator of cognitive suitability for studying particular courses at higher educational institutions, as suggested by Ronning et al and Witkin et al [21][22]. Analyses of the GEFT scores indicated that engineering and information technology students tended to have different cognitive styles. Engineering students were most likely to be more field-independent, while information technology students were inclined to be slightly more field-dependent. This is consistent with earlier findings that engineering students were more field-independent in orientation [16][23][24].

Thus, patterns of cognitive style among students intending to major in engineering or information technology showed the expected trends: engineering attracted more field-independent students, while information technology attracted more field-dependent students.

The results of analyses of the GEFT scores across the intended academic major contributed towards a person understanding the distinct individual differences in the process of selecting an academic major. As expected, students planning to study engineering tended to have higher GEFT scores than those choosing information technology. The findings again support the validity of cognitive style as being indicative of cognitive suitability in academic-major decision-making [22].

The results also supported the idea that a particular cognitive style is appropriate to a given academic field of study. Field-independent students tend to choose academic majors that require cognitive-restructuring skills, such as engineering. Field-dependent individuals tend to choose areas that require greater social and interpersonal involvement, such as information technology, law and the humanities [25].

With regard to the relationships between personality and chosen academic major, students generally differed only on the *openness* factor. The expectation was that students intending to major in information technology would be higher on *openness* than those opting for engineering was supported. This seems logical as the nature of information technology requires prospective students to be open to new ideas, technological innovations and new products.

Dollinger found *openness* to be positively related to information-oriented identity style, a style possessed by those who prefer to actively seek out and process information actively before making decisions [26]. Interestingly, this is what is going to be experienced by students engaged in the information technology field, later in the study, as well as in the work environment.

Prospective information technology students were also higher in *openness to actions*. According to Costa and McCrae, *openness to actions* is seen behaviourally in the willingness to try different activities and a preference towards novelty and varieties, which is also one of the characteristics of information technology students [17]. This may explain why the level of *openness* is higher among prospective students of information technology than future engineering students.

Implications

The study implies that there is a need for the assessment of students' cognitive styles so that the results can be used in helping students to choose the appropriate academic major. The use of the GEFT as a tool to diagnose an individual's style of information processing may aid not only in formulating a counselling approach, but also in identifying students who may need assistance in selecting an academic major. In addition, a cognitive-style assessment could provide students with a general, academic and vocational direction towards science, engineering or a non-science vocation.

Therefore, students could be advised to choose courses based on the match between the cognitive style and the nature of the subjects. Indeed, this is consistent with the suggestion by Messick, who emphasised the potential contribution of cognitive style to improve guidance and vocational decisions [27]

The administration of the GEFT to students in some way can support the identification of diversity in an educational setting. In other words, exposing students to valuable information about themselves may enable students to distinguish their strengths and weaknesses and their own suitability to major in a particular area.

The next general point is that, at the stage of matriculation or pre-university level, each student should be given the opportunity to explore his/her *self* in terms of personality (affective) and cognitive style (cognitive). One of the advantages may be that knowledge about their type of cognitive style through GEFT scores can help students overcome possible lower self-confidence about their ability to pursue professional courses.

As pointed by Bodden and James, providing relevant information, such as the results of exploring oneself, can be a useful aid for good decision-making [28]. The GEFT has also been related to therapeutic preferences and career choice [6]. Accurate and appropriate feedback on personality traits and cognitive ability can give students a new perspective about themselves, their problems, as well as their future choice of academic major and career [29].

REFERENCES

1. Crites, J.O., *Vocational Psychology*. New York: McGraw-Hill (1969).
2. Holland, J.L., *The Self-Directed Search: Professional Manual*. Odessa: Psychological Assessment Resources (1985).
3. Super, D.E., Consistency and wisdom of vocational preferences as indices of vocational maturity in the 9th grade. *J. of Educational Psychology*, 52, 35-43 (1961).
4. Holland, J.L., *Making Vocational Choices: A Theory of Vocational Personalities and Work Environments* (3rd edn). Odessa: Psychological Assessment Resources (1997).
5. Kassebaum, D.G. and Szenas, P.L., Factors influencing the specialty choices of 1993 medical school graduates. *Academic Medicine*, 69, 163-170 (1994).
6. Witkin, H.A., Moore, C.A., Goodenough, D.R. and Cox, P.W., Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, 47, 1-64 (1977).
7. Osipow, S.H., Cognitive styles and educational-vocational preferences and selections. *J. of Counseling Psychology*, 16, 534-546 (1969).
8. Karabel, J. and McClelland, K., Occupational advantage and the impact of college rank on labor outcomes. *Sociological Inquiry*, 57, 323-347 (1987).
9. McCrae, R.R. and Costa, P.T. Jr. The NEO Personality Inventory: using the five-factor model in counseling. *Journal of Counseling and Development*, 69, 367-372 (1991).
10. Witkin, H.A., Oltman, P.K., Raskin, E. and Karp, S.A., *A Manual for the Embedded Figures Test.* Palo Alto: Consulting Psychologists Press (1974).
11. McCrae, R.R. and John, O.P., An introduction to the five-factor model and its applications. *J. of Personality*, 60, 175-217 (1992).
12. Tokar, D.M. and Subich, L.M., Relative contributions of congruence and personality dimensions to job satisfaction. *J. of Vocational Behavior*, 50, 482-491 (1997).
13. Rigley, D.A., *The Relationship Between Personality Type, Academic Major Selection and Persistence*. Unpublished PhD dissertation, Illinois State University, Normal, USA (1993).
14. McCrae, R.R. and Costa, P.T. Jr., Validation of the five-factor model of personality across instruments and observers. *J. of Personality and Social Psychology*, 52, 81-90 (1987).
15. McCrae, R.R., The five-factor model and its assessment in clinical settings. *J. of Personality Assessment*, 57, 399-414 (1991).
16. Witkin, H.A., Goodenough, D.R. and Karp, S.A. Stability of cognitive style from childhood to young adulthood. *J. of Personality and Social Psychology*, 7, 291-300 (1967).
17. Costa, P.T. Jr. and McCrae, R.R., *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual.* Odessa: Psychological Assessment Resources, Inc. (1992).
18. McCrae, R.R., *Why I Advocate the Five-Factor Model: Joint Analyses of the NEO-PI with other Instruments*. In: Buss, D.M. and Cantor, N. (Eds), Personality Psychology: Recent Trends and Emerging Directions. New York: Springer-Verlag, 237-245 (1989).
19. Mastor, K. A., Cooper, M. and Jin, P., Malay culture and personality. *American Behavioural Scientist*, 44, **1**, 95-111 (2000).
20. Oltman, P.K., Raskin, E. and Witkin, H.A., *Group Embedded Figures Test.* Palo Alto: Consulting Psychologists Press (1971).
21. Ronning, R.R., McCurdy, D. and Ballinger, R., Individual differences: A third component in problem-solving instruction. *J. of Research in Science Teaching*, 21, **1**, 71-82 (1984).
22. Witkin, H.A., Moore, C.A., Oltman, P.K., Goodenough, D.R., Friedman, F., Owen, D.R. and Raskin, E., Role of the field dependent and field independent cognitive styles in academic evolution: a longitudinal study. *J. of Educational Psychology*, 69, 197-211 (1977).
23. Goodenough, D.R. and Witkin, H.A. (1977). Origins of the field dependent and field independent cognitive styles. *ETS Research Bulletin RB-77-9*, Princeton: Educational Testing Service (1977).
24. Watkins, D. and Astilla, E., Field independence as a predictor of Filipino university engineering grades. *Educational and Psychological Measurement*, 41, 893-895 (1981).
25. Witkin, H.A. and Goodenough, D.R., Field dependence and interpersonal behavior. *Psychological Bulletin*, 84, 661-689 (1977).
26. Dollinger, S.M.C., Identity styles and the five-factor model of personality. *J. of Research in Personality*, 29, 475-479 (1995).
27. Messick, S., The nature of cognitive styles: problems and promise in educational practice. *Educational Psychologist*, 19, **2**, 59-74 (1984).
28. Bodden, J. and James, L., Influence of occupational information giving on cognitive complexity. *J. of Counseling Psychology*, 19, 257-258 (1976).
29. McCrae, R.R. and Costa, P.T. Jr., Self-concept and the stability of personality: cross sectional comparisons of self-reports and ratings. *J. of Personality and Social Psychology*, 43, 1282-1292 (1982).