Library Progress International *Print version ISSN 0970 1052*
Vol.44 No.3, Jul-Dec 2024: P.7382-7387 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

Students' Personality Type: Does it Affect Relational Reasoning in Solving Mathematics Problems?

[1]Gemi Susanti, [1]Mega Teguh Budiarto, [1]Siti Khabibah[*], [1,2]Hodiyanto

[1]Universitas Negeri Surabaya, Lidah Wetan Road, Surabaya, Indonesia
[2]IKIP PGRI Pontianak, Ampera street no. 88 Pontianak New City, Pontianak, Indonesia

How to cite this article: Gemi Susanti, Mega Teguh Budiarto, Siti Khabibah, Hodiyanto (2024) Students' Personality Type: Does it Affect Relational Reasoning in Solving Mathematics Problems?. *Library Progress International,* 44(3), 7382-7387.

ABSTRACT

This study aimed to investigate the differences in relational reasoning between extroverted and introverted personality types using the statistical Analysis of Variance (ANOVA) method in the Independent Sample Test. This study tested the hypothesis that the variables measured showed significant differences between the two personality types, with the sample selected based on indicators of relational reasoning. The results showed that the value of "Equal Variance Assumed" was 0.97, higher than 0.05, and had a significance value (sig) of 0.426, exceeding the threshold of 0.05. The findings showed no statistically significant differences between extroverted and introverted students, suggesting an assumed similarity in variance between the two groups.

KEYWORDS

Anova, Extrovert, Introvert, Relational Reasoning.

1. Introduction

Reasoning is part of the many intelligences that are so useful and important that students must have and master, especially when studying mathematics lessons [1], [2], [3], [4]

According to research [5], reasoning is an essential mathematical skill needed to understand mathematical concepts, use flexible mathematical ideas and steps, and rebuild understanding related to mathematical knowledge. Implicitly, it can be concluded that reasoning plays a vital role in helping students solve math problems.

According to research [6], [7], one type of reasoning considered essential for human mental life is relational reasoning because it describes the vital ability of humans in thinking and learning. In this case, relational rationale can be said to be a type of reasoning related to the ability of learners to process material more deeply and to develop or relate knowledge previously acquired [8], [9]. According to research [10], [11], confirms that relational reasoning ability has been empirically linked to diverse aspects of mathematics learning and student achievement.

Relational reasoning is the ability to see and use the possibilities present in information to establish relationships between concepts in forming a coherent schema [12], [13]. According to research [6], relational reasoning includes understanding analogies between seemingly different objects or events and applying abstract rules in new situations. Relational reasoning is much like what Skemp says about relational understanding: knowing what is done and why it is done. Relational knowledge of a person's ability to use a mathematical procedure comes from connecting various relevant mathematical concepts in solving a problem and knowing why the method can be used (knowing what to do and why). Relational reasoning abilities are essential for mathematics education and everyday life. This ability includes the process of thinking logically to solve mathematical problems and draw conclusions based on the data or information provided [14]. It is not only students or academics who need relational reasoning skills. These abilities are also crucial for making everyday decisions and working in various fields [15]. Many things affect how a person thinks and reasons, including personality type. Each student with a different personality type has a different way of reasoning [16]. Individual and personality differences lead to differences in his thinking skills [17], [18]. According to research [16], differences in thinking can be understood with a personality classification approach. Therefore, individual and personality differences lead to differences in his thinking skills. Personality is the dynamic organization of a person's psychophysical system that influences how an individual adapts to the surrounding environment.

Grouping between extroverted and introverted personality types can describe each individual's interaction and social communication pattern. Extroverted personality type refers to individuals focusing more on the outside world, interactions with others, and community. Individuals with this type tend to be open, friendly, pleasant, and expressive in speech. They like to collaborate and have a vast social network. In contrast, introverted personality types display opposite traits, focusing more on oneself.

Many people have used the Myers-Briggs Type Indicator (MBTI) personality model [19] to describe and predict various aspects of their lives, such as academic and career achievement. The model has five dimensions: extroversion, politeness, openness to experience, earnestness, and neuroticism. A person's personality can affect their learning and problem-solving, including math.

Previous research has shown that various personality dimensions, such as relational reasoning, are related to cognitive abilities [10], [11]. For example, individuals with high scores in openness to experience tend to do better at tasks requiring creative and abstract thinking, an essential aspect of mathematical thinking. Conversely, a more systematic and organized approach to solving problems, including mathematical problems, can be associated with a high level of consciousness [20].

A study examining the relationship between personality and relational reasoning can be helpful in math education because both areas are critical [9], [21]. In particular, understanding how specific dimensions of personality can help in developing more appropriate learning strategies; these strategies, in turn, can improve student learning outcomes across different personality types [22], [23], [24].

This study aimed to identify non-cognitive constructs that directly and strongly relate to students' academic performance. To begin their review, these studies used non-cognitive frameworks and constructs [25]. By analyzing a variety of non-cognitive constructs at the domain level, the study contributes to the existing literature with empirical evidence.

In this study, personality types were classified into two types, namely extrovert and introverted personality types [26][27][28][17][29][30]. Someone with an extroverted personality is likelier to be sociable; his thinking is much more open, and his environment influences his feelings and behavior. While someone with an introverted personality tends to be more introverted, his thinking and behavior are centered on himself [31].

Jung was a prominent psychologist who popularised the theory of personality elements, Introverts and Extroverts. This theory explains that introverts tend to get energy from within themselves and focus on internal aspects, such as being alone in the room. On the other hand, extroverts concentrate on external factors, draw energy from interactions with others, and are more extroverted. The research mentioned in the search results aimed to compare the abilities of Extroverted and Introverted personalities in learning English, showing differences in speaking, writing, listening, and reading skills between the two personality types [32], [33].

This research is necessary because by understanding the role of personality in students' relational reasoning, teachers can be more effective in identifying and supporting students who may have difficulty in math. Students can also be empowered to recognize their strengths and weaknesses in mathematics. This can encourage them to develop better learning strategies that suit their personality type.

2. Scope and Methodology

This study was designed with a systematic and structured methodology to understand the influence of personality type on the results of relational reasoning. A comparative quantitative approach was used to determine the significant difference in the relational reasoning ability of students with extroverted and introverted personality types. This study used a comparative quantitative design to compare the results of relational reasoning with the personality types of extroverts and introverts. This approach allowed researchers to measure and analyze quantitative differences in relational reasoning scores between the two personality groups. The study subjects were grade VIII students of Watubangga 1 Middle School, consisting of 111 students. Extroverted personality type subjects 50 students, and introverted personality type subjects 61 students. Subjects given the MBTI Personality Questionnaire were used to determine whether subjects were extroverted or introverted. The subject's personality type will be determined using the MBTI scale, a math problem test of 10 essay questions to multiply students' relational reasoning.

First,su bjects will complete an MBTI questionnaire to determine the student's personality type. Next, students are asked to solve two essay questions to reveal their relational reasoning. Statistical software will be used to analyze the collected data. The sample characteristics and distribution of relational reasoning scores will be explained through descriptive analysis. Depending on the data distribution, the statistical analysis of variance (ANOVA) or t-independent test will be used to compare the results of extroverted and introverted relational reasoning.

3. Result and Discussion

The focus of this study was to understand how the results of relational reasoning differ between extroverted and introverted individuals. The MBTI questionnaire is used to classify students' personalities. Results showed

that 50 students were classified as extroverts and 61 as introverts. Figure 1. shows the distribution of the results of such classifications.

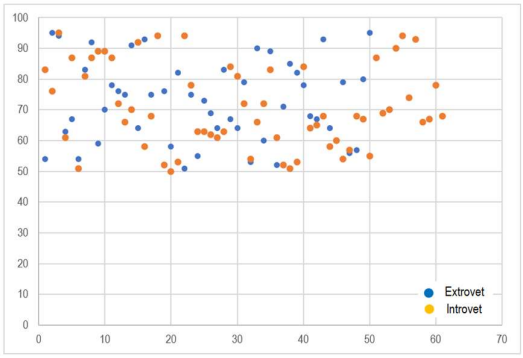

Figure 1. Distribution of the results of such classifications

Students' relational reasoning ability is assessed through a ten-question test. Table 1. Shows the percentage of students' relational reasoning ability.

Table 1. Percentage of test results for extrovert student type

Category	Range	f	Percentage %
Very high	86 – 100	11	22
High	71 – 85	15	30
Sufficient	56 – 70	18	36
Low	41 – 55	6	12
Very low	< 40	0	0

Table 1. Shows the frequency distribution of relational reasoning abilities of extroverted students, categorized into five levels: very high, high, medium, low, and very low. No extroverted students were in the very low category (i.e., with relational reasoning scores below 40). Of the 50 extroverted students tested, 11 (or 22 percent) scored very high, demonstrating exceptional relational reasoning ability. Fifteen students, or thirty percent of the total, fit into the high category, demonstrating solid relational reasoning skills. Among the categories, the largest group is the medium category, indicating moderate relational reasoning ability. Eighteen out of 50 students fall into this category. Lastly, only six students (12 percent) were in a low category, suggesting that a small proportion of extroverted students face challenges in relational reasoning. This distribution gives an idea of the relational reasoning abilities of extroverted students. Most students show moderate to very high abilities, while very few show low or very low abilities. Figure 2. Shows statistics on the frequency of students with extrovert-type ability outcomes.

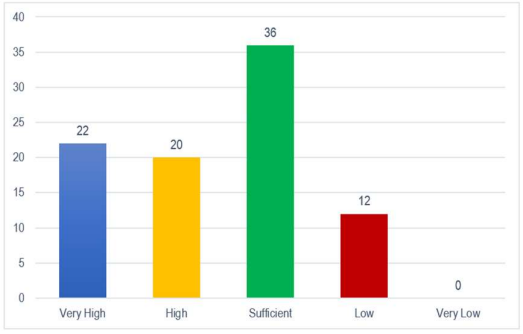

Figure 2. Frequency of extrovert-type students' ability outcomes

Table 2. Percentage of test results for extrovert student type

Category	Range	f	Percentage %
Very high	86 – 100	13	21
High	71 – 85	13	21
Sufficient	56 – 70	25	41
Low	41 – 55	10	16
Very low	< 40	0	0

Of the introverted students tested, 13 (or 21 percent) scored very high, demonstrating exceptional relational reasoning ability. The exact number, 13 students (21 percent), fell into the high category, showing strong reasoning ability but not as strong as those in the very high category. With 25 students or 41 percent, the largest category was average. This shows that most students have adequate relational reasoning skills. Relational reasoning proved challenging for only ten low students, accounting for 12% of the total students. Interestingly, none scored below 40, meaning no students were in the very low category. Figure 3. Shows statistics on the frequency of ability outcomes of introvert-type students.

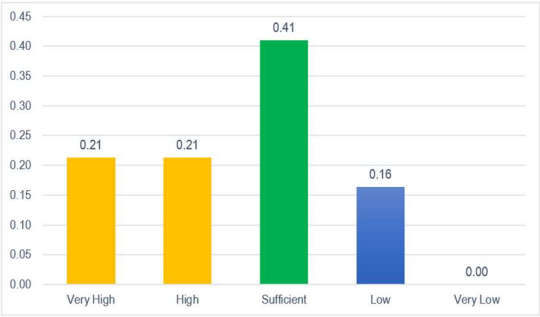

Figure 3. Frequency of ability outcomes of introvert-type students

Next, the collected data is analyzed. Data analysis used statistical ANOVA to determine whether the two personality groups significantly differed in rational reasoning scores. The results of the statistical ANOVA are shown in Table 3. Below.

Table 3. The results of the statistical ANOVA

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Result	Equal variances assumed	0.001	0.97	0.799	109	0.426	2.056	2.574	-3.04	7.157
	Equal variances are not assumed.			0.8	105.05	0.426	2.056	2.572	-3.04	7.156

Based on the results of the independent sample test where the value of "Equal variances assumed" is 0.97, which is greater than 0.05, and the significance value (sig. 2-tailed) is 0.426, also more significant than 0.05, we can conclude that there is no statistically significant difference between the extroverted and introverted personality types tested. This shows that the assumption of variance equality between groups is met, and the mean difference between groups is insignificant.

Discussion

This research offers a new understanding of the relationship between personality and relational reasoning ability. Based on the results, it can be concluded that personality tendencies do not significantly influence relational reasoning, at least in the case of extroverts and introverts. Introverts' tendency to work in a calmer, more controlled environment contrasts the notion that introverts may have an edge in tasks requiring concentration and deep thinking, such as relational reasoning. However, extroverts, who typically excel in social settings, may be expected to perform less well on tests of relational reasoning when working individually.

There are some limitations to this study. First, a relational reasoning test consisting of only ten questions may not fully reflect overall relational reasoning ability. Second, the MBTI can measure personality dimensions, but various factors, such as participants' psychological state when filling out questionnaires, can influence the results. Lastly, the study sample of 111 individuals may not be sufficient to generalize the findings to a larger population.

More research is needed to understand how relational reasoning ability and personality are related. Types of relational reasoning tasks, trial environments, and learning interventions specifically designed for specific personality types are some additional examples that might influence these relationships in future research. Using a larger sample size and further diversification in terms of "demographics can provide a deeper understanding of the correlation between personality and relational reasoning ability.

4. Conclusion

The results of an independent sample test in this study comparing extroverted and introverted personality types showed an Estimated Equal Variance" value of 0.97, well above the threshold of 0.05. Significance value (sig) also sig. (2-tailed) obtained a score of 0.426, exceeding the critical value of 0.05. These results showed that the variables measured in the extrovert and introvert groups did not have statistically significant differences. The variables measured in both groups were considered equal.

This conclusion greatly influences the understanding of personality types. First, the results of this study did not distinguish between extroverts and introverts in behavior and characteristics. Second, it suggests that personality type may not significantly influence, as is often assumed in the psychological literature, at least for the variables measured in the study**.**

Acknowledgements

We thank Balai Pembiayaan Pendidikan Tinggi (BPPT) and Lembaga Pengelola Dana Pendidikan (LPDP) for providing the Indonesian Education Scholarship 2021 and the School of Postgraduate Studies, State University of Surabaya for all the supports.

References

[1] S. Maskar and T. Herman, "The relation between teacher and students' mathematical mindsets to the student's comprehension of mathematics concepts," *j. math. educ.*, vol. 15, no. 1, pp. 27–54, 2024, doi: 10.22342/jme.v15i1.pp27-54.

[2] R. Kurniawan, L. B. Silalahi, C. Limbong, and H. Tambunan, "Analisis literasi, komunikasi dan penalaran matematika terhadap hasil belajar siswa selama pembelajaran e-learning," *Jurnal Pendidikan Matematika: Judika Education*, vol. 4, no. 1, pp. 56–70, 2021, doi: 10.31539/judika.v4i1.2312.

[3] J. C. Cabuquin, "Examining multiple intelligences and performance of science, technology, engineering, and mathematics (STEM) students in the specialized subjects," *EJEDU*, vol. 3, no. 5, pp. 55–60, Sep. 2022, doi: 10.24018/ejedu.2022.3.5.426.

[4] L. M. Sánchez-Ruiz, S. Moll-López, A. Nuñez-Pérez, J. A. Moraño-Fernández, and E. Vega-Fleitas, "ChatGPT challenges blended learning methodologies in engineering education: a case study in mathematics," *Applied Sciences*, vol. 13, no. 10, p. 6039, May 2023, doi: 10.3390/app13106039.

[5] K. Brodie, *Teaching Mathematical Reasoning in Secondary School Classrooms*. New York: Springer., 2010.

[6] D. Dumas, "Relational Reasoning and Its Manifestations in the Educational Context: A Systematic Review of the Literature," *Educational Psychology Review*, vol. 25, no. 3. pp. 391–427, 2013. doi: 10.1007/s10648-013-9224-4.

[7] D. R. Hofstadter, "Analogy as the Core of Cognition," *The College Mathematics Journal*, vol. 13, no. 2, pp. 98–114, 1982.

[8] S. Jablansky, P. A. Alexander, D. Dumas, and V. Compton, "The development of relational reasoning in primary and secondary school students: a longitudinal investigation in technology education," *Int J Technol Des Educ*, vol. 30, no. 5, pp. 973–993, Nov. 2020, doi: 10.1007/s10798-019-09529-1.

[9] P. A. Alexander, N. Gans, and A. J. K. Maki, "Relational reasoning in tertiary education: what is its value and how can it be assessed and trained?," *Front. Educ.*, vol. 7, pp. 1–14, 2022, doi: 10.3389/feduc.2022.883370.

[10] E. M. Grossnickle, D. Dumas, P. A. Alexander, and P. Baggetta, "Individual differences in the process of relational reasoning," *Learning and Instruction*, vol. 42, pp. 141–159, Apr. 2016, doi: 10.1016/j.learninstruc.2016.01.013.
[11] P. A. Alexander, D. Dumas, E. M. Grossnickle, A. List, and C. M. Firetto, "Measuring relational reasoning," *The Journal of Experimental Education*, vol. 84, no. 1, pp. 119–151, 2016.
[12] J. E. Hummel and K. J. Holyoak, "Relational reasoning in a neurally plausible cognitive architecture: An overview of the LISA project," *Current Directions in Psychological Science*, vol. 14, no. 3, pp. 153–157, 2005.
[13] B. J. Knowlton, R. G. Morrison, J. E. Hummel, and K. J. Holyoak, "A neurocomputational system for relational reasoning," *Trends in cognitive sciences*, vol. 16, no. 7, pp. 373–381, 2012.
[14] R. Rohati, Y. S. Kusumah, and K. Kusnandi, "Exploring students' mathematical reasoning behavior in junior high schools: a grounded theory," *Education Sciences*, vol. 13, no. 3, p. 252, Feb. 2023, doi: 10.3390/educsci13030252.
[15] P. A. Alexander, "Individual differences in college-age learners: The importance of relational reasoning for learning and assessment in higher education," *British Journal of Educational Psychology*, vol. 89, no. 3, pp. 416–428, 2019.
[16] R. Amelia and I. Ismail, "Pemahaman konsep segiempat siswa ditinjau dari tipe kepribadian ekstrovert-introvert dan jenis kelamin," *MATHEdunesa*, vol. 9, no. 1, pp. 231–240, Jun. 2020, doi: 10.26740/mathedunesa.v9n1.p231-240.
[17] M. N. Pratiwi and Suparman, "Mathematical module design to improve creative thinking skills based on problem based learning," *International Journal of Scientific & Technology Research*, vol. 8, no. 10, pp. 3761–3765, 2019.
[18] E. R. Bahrudin, "Profil pemahaman konsep siswa kelas vii materi bangun datar ditinjau dari tipe kepribadian ekstrovert dan introvert," *Jurnal Pendidikan Matematika*, vol. 7, no. 2, p. 168, Dec. 2019, doi: 10.20527/edumat.v7i2.6408.
[19] K. C. Briggs, *Myers-Briggs Type Indicator: MBTI*. Consulting Psychologists Press, 1974.
[20] J. A. LePine, J. A. Colquitt, and A. Erez, "Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness to experience," *Personnel psychology*, vol. 53, no. 3, pp. 563–593, 2000.
[21] B. Jonsson, J. Mossegård, J. Lithner, and L. K. Wirebring, "Creative mathematical reasoning: does need for cognition matter?," *Frontiers in Psychology*, vol. 12, pp. 1–10, 2021, doi: 10.3389/fpsyg.2021.797807.
[22] A. Furnham, "Personality and approaches to learning," *The Wiley-Blackwell Handbook of Individual Differences*, pp. 588–607, 2011.
[23] M. Khatibi and F. Khormaei, "Learning and personality: A review," *Journal of educational and management studies*, vol. 6, no. 4, pp. 82–90, 2016.
[24] R. Moody, "Motivation, learning strategies, and personality," *Journal of the First-Year Experience & Students in Transition*, vol. 5, no. 1, pp. 37–75, 1993.
[25] Oecd, *PISA 2022 results (volume I): the state of learning and equity in education*. Paris: OECD Publishing, 2023.
[26] C. G. Jung, *Psychologische typen*. Netherlands: Netherlands: Lemniscaat Publishers, 2003.
[27] H. Hasanah, M. Mardiayana, and Sutrima, "Analisis proses berpikir siswa dalam memecahkan masalah matematika ditinjau dari tipe kepribadian extrovert-introvert dan gender," *Jurnal Pembelajaran Matematika*, vol. 1, no. 4, pp. 422–434, 2013.
[28] A. Yuwono, "Problem solving dalam pembelajaran matematika," *Union: Jurnal Ilmiah Pendidikan Matematika*, vol. 4, no. 1, pp. 143–156, 2016, doi: doi.org/10.30738/.v4i1.420.
[29] C. T. Frey-Wehrlin and M. Liebscher, "Jung, Carl Gustav: psychologische typen," in *Kindlers Literatur Lexikon (KLL)*, H. L. Arnold, Ed., Stuttgart: J.B. Metzler, 2020, pp. 1–2. doi: 10.1007/978-3-476-05728-0_9212-1.
[30] I. A. D. Goma and V. C. Moneva, "Extrovert personality types and self-confidence- a case study from Philippines," *IRA International Journal of Education and Multidisciplinary Studies*, vol. 16, no. 1, pp. 68–75, 2020, doi: 10.21013/jems.v16.n1.p10.
[31] S. Loehken, *Quiet impact: how to be a successful introvert*. United State of America: McGraw-Hill, 2014.
[32] Y. Jung, "Towards an ecological account of media choice: A case study on pluralistic reasoning while choosing email," *Information Systems Journal*, vol. 24, no. 3, pp. 271–293, 2014, doi: 10.1111/isj.12024.
[33] Y. Travolta, . M., and . I., "A comparative study on introvert and extrovert students personality in english listening scores," *JEET*, vol. 2, no. 2, pp. 9–19, Sep. 2018, doi: 10.33369/jeet.2.2.9-19.