ASM Sc. J., 20(2), 2025
https://doi.org/10.32802/asmscj.2025.1973

Analysis of Honey Mumford Learning Styles and Their Implications for Algebraic Thinking Abilities

Masnia, S.B. Waluya*, Dwijanto and I. Kharisudin

Department of Mathematics, Faculty of Mathematics and Natural Science Universitas Negeri Semarang, Indonesia

Understanding learning styles is vital for enhancing educational quality, particularly in higher education. The Honey Mumford model categorises learners as Activists, Reflectors, Theorists, or Pragmatists, and is widely used to examine learning preferences. This study explores how these styles influence algebraic thinking among Information Technology students at Universitas Dian Nusantara Jakarta. A quantitative correlational approach was applied, involving 95 purposively selected students. Data were gathered using the Learning Styles Questionnaire (LSQ) and an algebraic thinking skills test, then analysed with SmartPLS 3. Findings reveal that the Reflector style is most prevalent (62%), followed by Theorist (57%) and Pragmatist (26%). The Pragmatist style significantly improves algebraic thinking at the meta-global and transformational levels. Conversely, Activist and Reflector styles negatively impact the meta-global dimension, while the Theorist style shows no notable effect. The novelty of this study lies in its specific focus on the relationship between learning styles and distinct dimensions of algebraic thinking—an area scarcely addressed in educational research. These insights highlight the importance of adaptive teaching strategies tailored to individual learning styles, particularly in promoting higher-order thinking. This research contributes to the development of more personalised, cognitively effective instruction within the context of Information Technology education.

Keywords: learning styles; algebraic thinking skills; Honey Mumford; information technology

I. INTRODUCTION

Understanding learning styles is a vital aspect of enhancing the quality of the educational process. At the higher education level, recognising students' learning preferences and selecting appropriate teaching strategies are essential for improving learning effectiveness. One of the most widely used learning style models among students is the Honey Mumford learning style, developed by Peter Honey and Alan Mumford (Kolb, 2014; Mumford, 2006). This learning style model has been applied in various educational contexts, including medical and management education, to determine the prevalence of learning styles among students and their correlation with teaching methods and academic performance (Bhalli *et al.*, 2015; Czepula *et al.*, 2016; Yadav *et al.*, 2020).

Research on learning styles and their implications for algebraic thinking skills remains limited. The Honey Mumford learning style model identifies four main characteristics: Activist, Reflector, Theorist, and Pragmatist (Honey & Mumford, 2024; 1992; 1986). Activists learn by directly engaging in new activities, Reflectors learn by observing and reflecting on experiences, Theorists learn by logically understanding concepts and theories, and Pragmatists learn by seeking practical ways to apply ideas in real-world situations.

However, there remains a lack of comprehensive understanding of how these learning styles influence students' algebraic thinking skills, particularly among Information Technology students. A study on industrial engineering students found that the Reflector style had the greatest impact on academic performance, followed by the

*Corresponding author's e-mail: budiw@mail.unnes.ac.id

Theorist style. Conversely, another study found no significant relationship between learning styles and academic achievement among nursing students.

Research conducted by Palacios M. *et al.* (2006) assessed learning styles among first-year medical students using the CHAEA questionnaire, revealing a dominance of reflective and theoretical learning styles. Britt and Irwin (2011) examined the development of algebraic thinking through a curriculum that emphasised the algebraic foundations of arithmetic operations. An analysis by Swailes and Senior (1999) evaluated the validity of the Honey Mumford Learning Style Questionnaire among UK managers, finding that the factor structure did not fully align with the theoretical four-stage learning cycle.

Ferdiani *et al.* (2021) described the creative thinking process of prospective teachers with a Reflector learning style, emphasising their focus on careful observation and decision-making. Other studies on learning styles based on Honey and Mumford's theory suggest that differences in learning styles, particularly between Theorist and Pragmatist styles, influence the creative thinking process in problem-solving (Ferdiani & Harianto, 2024).

Theorist learners tend to base problem-solving on previously understood theories, demonstrating systematic and structured characteristics in the synthesis and implementation stages of ideas. In contrast, Pragmatist learners focus more on practical aspects and direct application, often developing solutions based on observations and everyday experiences. These differences in characteristics result in distinct approaches to designing, planning, and implementing solutions to the same problems.

A collaborative approach to learning algebra, as examined by Kieran (2018), enhances algebraic thinking skills and conceptual understanding, making it relevant to all learning styles, particularly Activists and Theorists. İlçin *et al.* (2018) found that students with a Theorist learning style demonstrated consistent performance in understanding abstract algebraic concepts.

II. MATERIALS AND METHOD

The research method employed in this study is a quantitative approach with a correlational design. In this design, the researcher utilises correlation statistics to describe and measure the degree of association between two or more variables (Creswell, 2014). The research sample consists of 95 students from the Informatics Engineering study programme at Dian Nusantara University Jakarta, selected through purposive sampling based on their enrolment in the Calculus course.

The research procedure was conducted in several stages. The preparation stage involved instrument validation. During the data collection stage, students were asked to complete the Learning Style Questionnaire (LSQ) and take an algebraic thinking ability test. The LSQ, developed by Honey and Mumford, comprises 80 questions covering four learning styles: Activist, Reflector, Theorist, and Pragmatist. Each positive response was scored 1, while unanswered questions received no score. Completing the questionnaire required approximately 20 minutes. Based on the questionnaire scores, students' learning styles were categorised as very strong, strong, moderate, low, or very low. The collected data was then processed and analysed using SmartPLS 3 software.

The research instruments used in this study included the Learning Style Questionnaire (LSQ) and an algebraic thinking ability test. The LSQ comprises 80 questions divided into four sections, each containing 20 questions measuring the learning styles of Activist, Reflector, Theorist, and Pragmatist. Meanwhile, the algebraic thinking ability test was designed to assess students' skills in understanding, applying, and analysing algebraic concepts, with indicators covering generational, transformational, and meta-global aspects, as outlined by Kieran (2004).

Instrument validation was carried out using the expert validation method to evaluate the quality of the items based on three main aspects: item instructions, content, and language use. The validation process involved two algebraic thinking experts who assessed the items using a Likert scale ranging from 1 to 5. The data analysis results showed an average validation score of 4.1667, categorised as “good,” indicating that the instrument is suitable for use with some refinements for improvement.

The primary data was obtained directly from students through questionnaires and tests. The research data included each student's Learning Style Questionnaire scores and the results of the algebraic thinking ability test. The data was analysed using correlational statistical analysis techniques

with the assistance of SmartPLS 3 software. The data analysis process involved processing the questionnaire scores, measuring the relationship between learning styles and algebraic thinking ability using correlation analysis, and testing hypotheses to determine the significance of the relationships identified, with a p-value of < 0.05 considered statistically significant.

III. RESULT AND DISCUSSION

A total of 95 students were classified based on the learning style characteristics of Honey and Mumford. A very strong preference was observed for the Reflector style, chosen by 62% of students, followed by Theorist at 57%, Pragmatist at 26%, and the lowest preference for the Activist style at 12%. It is important to consider the overall proportion of students in each learning style and its respective categories.

Table 1. Honey Mumford Learning Style Scale

Learning Style	Activist	Reflector	Theorist	Pragmatist
Very strong	13-20	18-10	16-20	17-20
Strong	11-12	15-17	14-15	15-16
Moderate	7-10	12-14	11-13	12-14
Low	4-6	9-10	8-10	9-11

Source: (Honey & Mumford, 2024; Yadav *et al.*, 2020)

Table 2. Distribution of Percentage of Honey Mumford Learning Styles among Informatics Engineering Students

Learning Style	Activist	Reflector	Theorist	Pragmatist
Very Strong	12	62	57	26
Strong	21	28	18	25
Moderate	51	8	23	25
Low	12	2	2	24
Verry Low	5	0	0	0
Total	100	100	100	100

Table 1 and Table 2 The majority of students (51%) exhibit a moderate level of the Activist learning style, while nearly equal proportions display a strong (21%) and very strong (12%) preference for this style. Only a small percentage of students demonstrate a low (12%) or very low (5%) level of Activist learning style. The Reflector learning style is the most dominant among students, with 62% displaying a very strong preference and 28% a strong preference. Only a few students exhibit a moderate level (8%) or low level (2%), and none fall into the very low category. The Theorist learning style is also fairly prominent, with the majority (57%) classified in the very strong category and 18% in the strong category. A total of 23% of students demonstrate a moderate level of this style, while only 2% are in the low category, and none fall into the very low category. The Pragmatist learning style shows a more even distribution compared to the other styles. Approximately 26% of students exhibit a very strong preference, while strong and moderate levels are reported at 25% each. Nearly as many students demonstrate a low level (24%), with none falling into the very low category.

The distribution of learning styles among students reveals varying tendencies. The Reflector and Theorist styles are the most dominant at the very strong level, while the Pragmatist style exhibits a more balanced distribution. The Activist style has the highest number of students at the moderate level, yet students display varying degrees of intensity across all learning styles.

Table 3. Descriptive Statistics of Honey and Mumford Learning Styles among Informatics Engineering Students

Activist	Reflector	Theorist	Pragmatist	
Mean	9.19	16.54	14.51	14.76
SD	3.15	2.05	2.35	2.63
Median	9	17	14	15
Skewness	0.414	-0.591	-0.012	-0.303
Max	20	20	20	20
Min	3	10	8	6

Based on Table *3*, the Activist learning style has an average score of 9.19, indicating a relatively low preference compared to other learning styles. A standard deviation of 3.15 suggests considerable variation in preferences for this learning style. The median, which is equal to the mean at 9, indicates a fairly symmetrical distribution of scores. However, a positive skewness of 0.414 suggests that the distribution is slightly skewed to the right, meaning some students have scores higher than the average. The wide range of values, with a maximum of 20 and a minimum of 3, further highlights the significant variation in preferences for the Activist learning style.

The Activist learning style has an average score of 9.19, indicating a relatively low level of preference compared to

other learning styles. A high standard deviation (3.15) reflects considerable variation in preferences for this style. The score distribution is slightly skewed to the right, with some students scoring higher. In contrast, the Reflector category demonstrates a very high average score of 16.54, indicating a dominant preference for this style. A lower standard deviation (2.05) suggests relatively little variation in preferences for this style. The score distribution is skewed to the left, with more students scoring higher. The Theorist and Pragmatist categories show relatively high average scores of 14.51 and 14.76, respectively. Moderate variation in preferences for these styles is indicated by relatively high standard deviations (2.35 and 2.63). The score distributions for these styles are symmetrical and slightly skewed to the right, with some students scoring higher. In summary, the statistical analysis shows that the Reflector learning style has the highest preference, followed by the Theorist and Pragmatist styles, while the Activist style has a relatively low preference. The large variation in preferences for the Activist and Pragmatist styles suggests that some students score significantly higher, whereas the Reflector learning style exhibits a more symmetrical and consistently higher distribution.

The Reflector learning style is the most dominant, with the highest average score (16.54) and low variation, indicating a strong and consistent preference. The Theorist and Pragmatist styles also demonstrate high preference levels, with average scores of 14.51 and 14.76, respectively. Both styles exhibit moderate variation and relatively symmetrical distributions. The Activist style has the lowest average score (9.19) and significant variation, suggesting that preferences for this learning style are more diverse. The score distributions for Reflector and Pragmatist are skewed towards higher values, while the Activist style shows a slightly right-skewed distribution, indicating a few students with high scores. The recommended teaching approach is to acknowledge the dominance of the Reflector learning style while also incorporating varied teaching methods to accommodate the needs of Theorist, Pragmatist, and Activist learners.

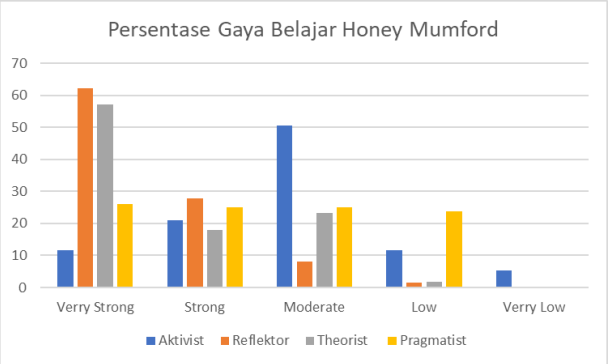

Figure 1. Graph showing the percentage of Information Technology students with varying levels of preference for the Honey Mumford learning styles.

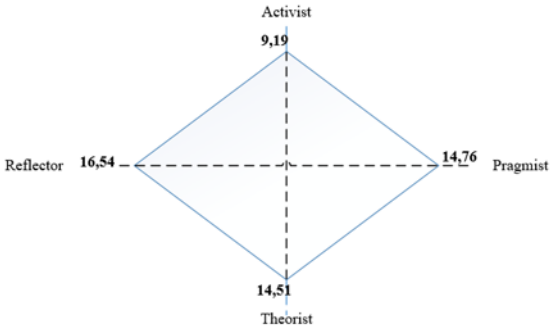

Figure 2. A kite diagram showing the average learning styles of Information Technology students.

Table 4. Descriptive statistics of algebraic thinking abilities among Information Technology students.

Generational	Transformational	Level meta global	
Mean	34	35	31
SD	19	18	12
Median	33	33	33
Skewness	-0.14301	-0.37672	0.49870
Maximum	78	67	67
Minimum	0	0	0

An analysis of algebraic thinking indicators based on the given data reveals several key differences across three levels: Generational, Transformational, and Meta Global. In terms of the mean, the Transformational level has the highest value at 35, followed by Generational at 34 and Meta Global at 31. This indicates that algebraic thinking abilities are strongest at the Transformational level. However, regarding the standard deviation (SD), Generational has the highest value at 19, followed by Transformational at 18 and Meta Global at 12, suggesting that the variation or spread of algebraic thinking abilities is greatest at the Generational level. The median is

consistent across all three levels at 33, indicating a stable central value for algebraic thinking abilities. The skewness for the Generational and Transformational levels is -0.14301 and -0.37672, respectively, indicating a slight left-skewed distribution. In contrast, the Meta Global level, with a skewness of 0.49870, exhibits a right-skewed distribution.

This suggests that at the Meta Global level, there are more individuals with below-average algebraic thinking abilities than above-average. The maximum values are the same for the Transformational and Meta Global levels at 67, while Generational reaches 78, indicating that some individuals possess exceptionally high algebraic thinking abilities, particularly at the Generational level. The minimum value is 0 across all levels, signifying that there are individuals at each level with very low or no algebraic thinking abilities. Overall, the data highlights significant variability in algebraic thinking abilities among individuals and across levels, with the greatest variation observed at the Generational level.

An analysis of the implications of Honey and Mumford's learning styles on algebraic thinking reveals significant variation among the four learning styles (Activist, Reflector, Theorist, Pragmatist) in relation to the three algebraic thinking indicators (Generational, Transformational, Meta-Global).

Based on the data provided, Reflectors have the highest mean (16.54) with the lowest standard deviation (2.05), indicating high stability and consistency in their learning style. This is likely to have a positive impact on algebraic thinking indicators, particularly Generational and Transformational, which have means of 34 and 35, respectively. The high median value for Reflectors (17) further reinforces their ability to process algebraic information in a deep and reflective manner.

An analysis of the implications of Honey and Mumford's learning styles on algebraic thinking highlights significant variations among the four learning styles (Activist, Reflector, Theorist, Pragmatist) in relation to the three indicators of algebraic thinking (Generational, Transformational, Meta-Global).

Based on the data provided, Reflectors have the highest mean (16.54) with the lowest standard deviation (2.05), indicating high stability and consistency in their learning style. This is likely to have positive implications for algebraic thinking indicators, particularly Generational and Transformational, which have means of 34 and 35, respectively. The high median value for Reflectors (17) further reinforces their strength in deep and reflective processing of algebraic information.

Conversely, Activists, with the lowest mean (9.19) and a high standard deviation (3.15), exhibit considerable variability and may be less suited to algebraic thinking, which requires structured and reflective thought. The positive skewness observed in Activists (0.414) suggests a tendency towards higher extreme values, indicating that while some Activists may achieve high performance in algebraic thinking indicators, their results are inconsistent.

Theorists and Pragmatists demonstrate relatively high means and moderate standard deviations (Theorists: 14.51 and 2.35; Pragmatists: 14.76 and 2.63). This suggests that both learning styles are well-suited to algebraic thinking, supported by their high median values (14 and 15), which reflect stable performance. The negative skewness observed in Reflectors (-0.591) and Pragmatists (-0.303) indicates a distribution skewed towards higher values, reinforcing the compatibility of these learning styles with the demands of algebraic thinking indicators. As a result, Reflectors and Pragmatists tend to excel in supporting algebraic thinking abilities, which require deep analysis and practical application. Meanwhile, Activists may need to adapt their approach to achieve optimal results in algebraic thinking.

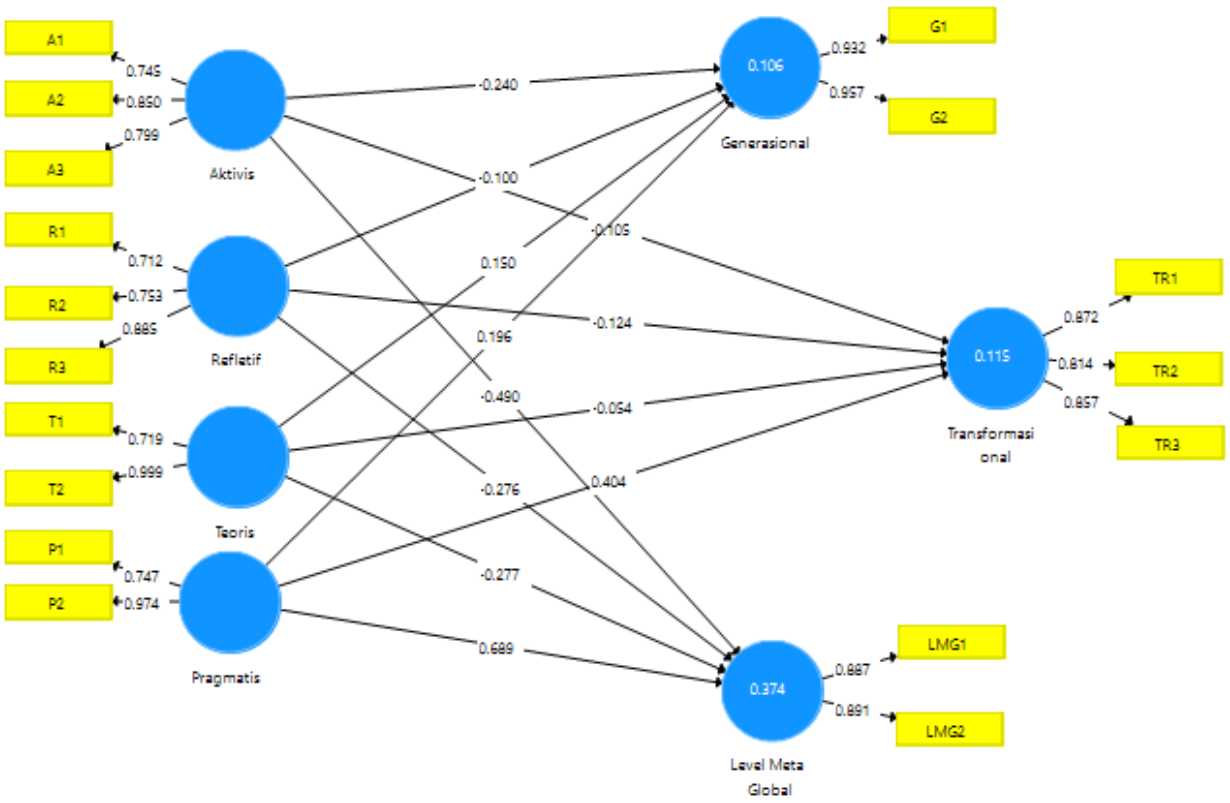

Figure 3. Diagram of Loading Factor Values for Honey Mumford's Learning Styles in Relation to Algebraic Thinking Abilities

Based on Table 3, the four Honey and Mumford learning styles—Activist, Pragmatist, Reflector, and Theorist—demonstrate good validity through the outer loading values obtained. For the Activist type, three indicators (A1, A2, and A3) have outer loading values of 0.745, 0.850, and 0.799, respectively. These values indicate that A2 is the strongest representation of the Activist learning style, while A1, although weaker, still falls within the valid range (>0.70). For the Pragmatist type, there are two indicators, P1 and P2, with outer loading values of 0.747 and 0.974. Indicator P2 has a significantly higher value, indicating that it is much stronger in representing the Pragmatist learning style compared to P1, though P1 remains valid with a value above 0.70. Meanwhile, the Reflector type has three indicators—R1, R2, and R3—with outer loading values of 0.712, 0.753, and 0.885, respectively. Indicator R3 has the highest value, suggesting it is the most representative of the Reflector type, while R1, despite being lower, still meets adequate validity criteria. For the Theorist type, two indicators, T1 and T2, show outer loading values of 0.719 and 0.999, respectively. The near-perfect value of T2 indicates it is extremely strong in representing the Theorist type, while T1 also demonstrates good validity.

In conclusion, the indicators of learning styles within the Honey and Mumford model demonstrate strong validity in representing each learning style type. With most outer loading values exceeding 0.70, it can be concluded that this measurement model is valid and can effectively be used to understand individual learning style preferences.

Based on the data processing results using SmartPLS 3 for algebraic thinking analysis, three main dimensions were measured: Generational, Meta-Global Level, and Transformational. Each dimension comprises several indicators, and the outer loading values of each indicator were analysed to assess their validity in measuring these dimensions of algebraic thinking.

For the Generational dimension, two indicators, G1 and G2, were used, with outer loading values of 0.932 and 0.957, respectively. These values indicate that the Generational indicators possess very strong validity, with G2 being slightly stronger in representing this dimension compared to G1. Both values are well above the 0.70 threshold, signifying that they are highly valid measures for the Generational dimension.

The second dimension, Transformational, comprises three indicators: TR1, TR2, and TR3, with outer loading values of 0.872, 0.814, and 0.857, respectively. While the values for this dimension are slightly lower compared to Generational and Meta-Global Level, all indicators remain above 0.70, confirming their reliability. TR1 has the highest value, indicating it is the strongest representation of the Transformational dimension, whereas TR2, with the lowest value, still provides a reliable measurement.

The Meta-Global Level dimension is measured using two indicators, LMG1 and LMG2, with outer loading values of 0.887 and 0.891, respectively. These values are relatively high and nearly balanced, demonstrating that both indicators significantly contribute to measuring the Meta-Global Level dimension. This reflects good consistency and strong validity for this dimension.

In conclusion, the three dimensions of algebraic thinking (Generational, Meta-Global Level, and Transformational) are supported by strong and valid indicators. With most outer loading values exceeding 0.80, it can be concluded that this measurement model is valid and provides a robust representation of the algebraic thinking abilities being studied.

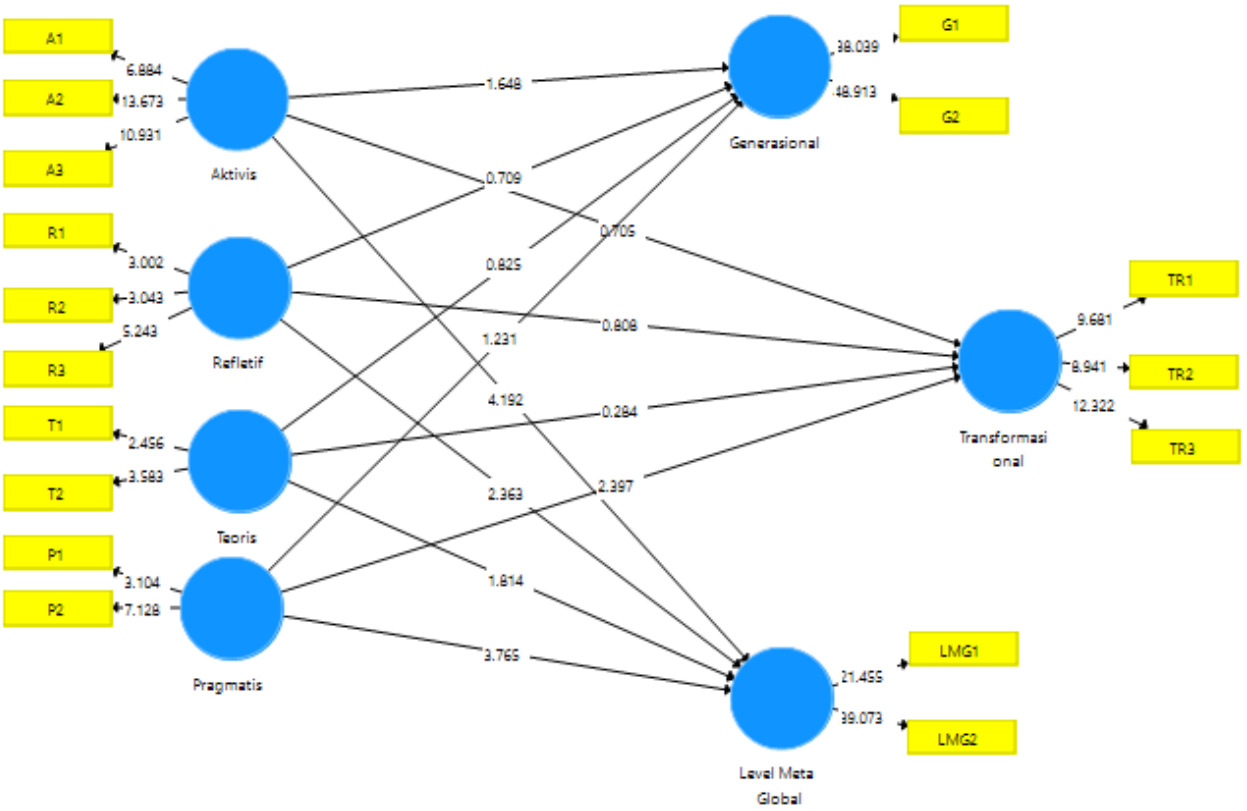

Figure 4. An In-Depth Analysis of Honey Mumford's Learning Styles in Relation to Algebraic Thinking

Table 5. An Analysis of the Coefficient of Honey Mumford's Learning Styles in Relation to Algebraic Thinking

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistic (| O/STDEV |)	P-Value
Activist -> Generational	-0.240	-0.235	0.146	1.648	0.100
Activist -> Transformational	-0.105	-0.081	0.150	0.705	0.481
Activist -> Meta-Global Level	-0.490	-0.486	0.117	4.192	0.000

ragmatist -> Generational	0.196	0.192	0.159	1.231	0.219
Pragmatist -> Transformational	0.404	0.361	0.169	2.397	0.017
Pragmatist -> Meta-Global Level	0.689	0.589	0.183	3.765	0.000
Reflector -> Generational	-0.100	-0.115	0.142	0.709	0.479
Reflector -> Transformational	-0.124	-0.134	0.153	0.808	0.420
Reflector -> Meta-Global Level	-0.276	-0.246	0.117	2.363	0.019
Theorist -> Generational	0.150	0.154	0.182	0.825	0.410
Theorist -> Transformational	-0.054	-0.042	0.191	0.284	0.776
Theorist -> Meta-Global Level	-0.277	-0.187	0.153	1.814	0.070

Based on the data analysis in Figure 4 and Table 5 regarding the implications of Honey and Mumford's learning styles on algebraic thinking abilities, there are differences in the influence of each learning style on the three dimensions of algebraic thinking: Generational, Transformational, and Meta-Global Level.

The Activist learning style demonstrates a significant negative impact on the Meta-Global Level dimension, with a value of -0.490 and a p-value of 0.000. This indicates that the more dominant the Activist learning style, the lower the individual's ability to think abstractly and globally. However, for the Generational and Transformational dimensions, the Activist learning style does not show a significant influence, with p-values of 0.100 and 0.481, respectively. This suggests that this learning style has no substantial effect on these two dimensions.

The Pragmatist learning style has a significant positive impact on Transformational thinking abilities (0.404, p-value = 0.017) and Meta-Global Level thinking abilities (0.689, p-value = 0.000). This suggests that individuals with a Pragmatist learning style are better equipped for algebraic thinking and can apply their knowledge in broader and more practical contexts. However, for the Generational dimension, its influence is not significant (p-value = 0.219), indicating that the Pragmatist learning style does not strongly affect abilities related to generating new ideas.

The Reflector learning style shows a significant negative impact on the Meta-Global Level dimension (-0.276, p-value = 0.019), implying that the higher an individual's level of reflection, the lower their ability to think at a global and abstract level. However, similar to the Activist learning style, Reflector does not have a significant influence on the Generational and Transformational dimensions, with p-values of 0.479 and 0.420, respectively.

The Theorist learning style does not show a significant impact on any of the three dimensions of algebraic thinking. Although there is a slight negative tendency towards the Meta-Global Level (-0.277, p-value = 0.070), this relationship is not strong enough to be considered significant, and the results remain non-significant for the Generational and Transformational dimensions as well.

The results of this analysis indicate that the Pragmatist learning style has a significant positive impact on algebraic thinking abilities, particularly in the Transformational and Meta-Global Level dimensions. In contrast, the Activist and Reflector learning styles tend to have a negative impact on Meta-Global Level thinking abilities. The Theorist learning style does not show a significant impact on algebraic thinking abilities across any of the three dimensions studied.

Based on the data analysis, it was found that Honey and Mumford's learning styles have varying effects on the algebraic thinking abilities of Informatics Engineering students. These findings align with the literature, which suggests that learning style preferences can influence learning outcomes, particularly in the context of analytical thinking and knowledge application.

For instance, the Activist learning style has been shown to have a significantly negative impact on Meta-Global Level thinking abilities. This supports earlier research by Kolb (1981), which indicated that learners with a concrete experience learning style, such as Activists, tend to be less effective in situations requiring abstract and analytical thinking. These findings align with recent research suggesting that active learning styles may face limitations in processing complex information. For example, Alsa *et al.* (2010) found that university students with an active learning style tend to have lower self-regulation efficacy, which may affect their ability to comprehend complex material.

Conversely, the Pragmatist learning style has been shown to have a significant positive impact on higher-order thinking skills. Wahyuningsih (2024) found that university students with a Pragmatist learning style tend to have better mathematical critical thinking skills, enabling them to integrate theory with real-world applications, thereby enhancing their mathematical reasoning abilities. This positive influence suggests that students with a Pragmatist learning style are generally more effective in algebraic thinking and in applying their knowledge to real-life contexts.

The Reflector learning style, while showing a significant negative impact on the Meta-Global Level dimension, does not exhibit a significant influence on the Generational and Transformational dimensions. This result aligns with the findings of Vermunt (1996), who observed that the Reflective learning style tends to prioritise deep thinking and self-evaluation but may not always be suitable for contexts requiring extensive information integration and global thinking. Consequently, students with a Reflective learning style may require additional support in learning environments that demand holistic and complex thinking abilities.

The Theorist learning style, while not showing a significant impact on any of the three dimensions of algebraic thinking, exhibits a slight negative tendency towards the Meta-Global Level dimension. This can be linked to previous research by Entwistle and Peterson (2004), which noted that learners with a Theorist learning style may lack flexibility in applying knowledge in unstructured situations. This suggests that, although the Theorist style supports systematic thinking processes, it has limitations when knowledge needs to be adaptively applied beyond theoretical frameworks.

Overall, these findings highlight the importance of tailored learning strategies that align with students' learning style preferences to enhance algebraic thinking abilities. As suggested by Coffield *et al.* (2004), adopting teaching approaches that account for variations in learning styles can have a more significant impact on learning outcomes. Given that the Pragmatist learning style shows a significant positive influence on higher-order thinking dimensions, the use of practice-based learning strategies should be prioritised. Conversely, for students with Activist and Reflector learning styles, more structured approaches that support deeper information integration are necessary to optimise their algebraic thinking abilities.

To enhance the effectiveness of teaching according to students' learning preferences, it is recommended that teaching methods be adjusted to their needs. Activist students can benefit from interactive learning activities such as simulations and group projects, paired with reflective sessions to connect experiences to abstract concepts. Pragmatist students are better supported by practice-based tasks and problem-based learning that allow for the application of theory in real-world scenarios. Reflector students may find value in reflective journals and group discussions to delve into complex material. Theorist students will benefit most from systematic and logical learning approaches, accompanied by tasks that encourage practical application to develop cognitive flexibility. This adaptive approach is expected to enhance algebraic thinking abilities more effectively.

IV. CONCLUSION

The research findings indicate that Honey and Mumford's learning styles have significantly different effects on the algebraic thinking abilities of Informatics Engineering students. The Pragmatist learning style has a significant

positive influence on Transformational and Meta-Global Level thinking abilities, suggesting that approaches emphasising practical application and analysis are more effective in developing algebraic thinking skills.

In contrast, the Activist and Reflector learning styles show a negative impact on Meta-Global Level thinking abilities, indicating that more structured and analytical learning approaches may be necessary to address these limitations. The Theorist learning style does not show a significant influence, implying the need for more varied approaches to support higher-order algebraic thinking abilities.

Thus, adaptive teaching strategies that take into account the characteristics of students' learning styles are expected to enhance the effectiveness of learning, particularly in fostering analytical thinking and solving more complex problems.

V. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the anonymous reviewers for their constructive comments, valuable suggestions, and thorough evaluation, which have significantly contributed to the improvement and refinement of this article.

VI. REFERENCES

Ashim, M, Asikin, M, Kharisudin, I & Wardono, W 2019, 'Perlunya Komunikasi Matematika dan Mobile Learning Setting Problem Based Learning untuk Meningkatkan Kemampuan 4C di Era Disrupsi', PRISMA, Prosiding Seminar Nasional Matematika 2, pp. 687–697.

Basir, MA, Waluya, SB, Dwijanto, D & Isnarto, I 2021, 'Development and use of Test Instruments to measure Algebraic Reasoning Based on Cognitive Systems in Marzano's Taxonomy', EUR J MATH SCI ED, vol. 2, pp. 163–175. Doi: 10.12973/ejmse.2.2.163

Basir, MA, Waluya, SB, Dwijanto & Isnarto 2022, 'How Students Use Cognitive Structures to Process Information in the Algebraic Reasoning?', EUROPEAN J ED RES, vol. 11, pp. 821–834. Doi: 10.12973/eu-jer.11.2.821

Bhalli, MA, Khan, IA & Sattar, A 2015, 'Learning style of medical students and its correlation with preferred teaching methodologies and academic achievement', Journal of Ayub Medical College, Abbottabad: JAMC, vol. 27, pp. 837–842.

Britt, MS & Irwin, KC 2011, 'Algebraic Thinking with and without Algebraic Representation: A Pathway for Learning', in: Cai, J., Knuth, E. (Eds.), Early Algebraization: A Global Dialogue from Multiple Perspectives, Advances in Mathematics Education, Springer, Berlin, Heidelberg, pp. 137–159. Doi: 10.1007/978-3-642-17735-4_10

Coffield, F, Moseley, D, Hall, E & Kathryn, E 2004, 'Learning styles and pedagogy in post-16 learning: A systematic and critical review', Wiltshire: The Learning and Skills Research Centre, vol. 182.

Creswell, JW 2014, 'Research design: qualitative, quantitative, and mixed methods approaches', 4th ed SAGE Publications, Thousand Oaks.

Czepula, AI, Bottacin, WE, Hipólito, E, Jr, Baptista, DR, Pontarolo, R & Correr, CJ, 2016, 'Predominant learning styles among pharmacy students at the federal university of Paraná, Brazil', Pharmacy Practice, vol. 14. Doi: 10.18549/PharmPract.2016.01.650

Entwistle, NJ & Peterson, ER 2004, 'Conceptions of learning and knowledge in higher education: Relationships with study behaviour and influences of learning environments', International Journal of Educational Research, vol. 41, pp. 407–428. Doi: 10.1016/j.ijer.2005.08.009

Ferdiani, RD & Harianto, W 2024, 'Honey and Mumford learning style: creative thinking process in solving statistical problems', International Journal of Evaluation and Research in Education (IJERE), vol. 13, pp. 496–502. Doi: 10.11591/ijere.v13i1.25347

Ferdiani, RD, Manuharawati, M & Khabibah, S 2021, 'Geometry material: Profile of creative thinking process of prospective teachers with reflector learning style in proposing and solving problems', J. Phys.: Conf. Ser. 1869, p. 012118. Doi: 10.1088/1742-6596/1869/1/012118

Gunawan, G, Kartono Kartono, Wardono, W & Kharisudin, I 2022, 'Analysis of Mathematical Creative Thinking Skill: In Terms of Self Confidence', INT J INSTRUCTION, vol. 15, pp. 1011–1034. Doi: 10.29333/iji.2022.15454a

Honey, P & Mumford, A 2024, The Learning Styles Questionnaire 80-Item Version.

Honey, P & Mumford, A 1992, 'The Manual of Learning Styles', Management Education and Development, vol. 14, pp. 147–150. Doi: 10.1177/135050768301400209

Honey, P & Mumford, A 1986, The Manual of Learning Styles, Peter Honey.

İlçin, N, Tomruk, M, Yeşilyaprak, SS, Karadibak, D & Savcı, S 2018, 'The relationship between learning styles and academic performance in TURKISH physiotherapy students', BMC Med. Educ., vol. 18, p. 291. Doi: 10.1186/s12909-018-1400-2

Kharisudin, I & Cahyati, NE 2020, 'Problem-solving ability using mathematical modeling strategy on model eliciting activities based on mathematics self-concept', J. Phys.: Conf. Ser., vol. 1567, p. 032067. Doi: 10.1088/1742-6596/1567/3/032067

Kieran, C (Ed.) 2018, 'Teaching and Learning Algebraic Thinking with 5- to 12-Year-Olds', ICME-13 Monographs. Springer International Publishing, Cham.

Kieran, C 2004, 'Algebraic thinking in the early grades: What is it', The Mathematics Educator, vol. 8, pp. 139–151.

Kolb, DA 2014, 'Experiential Learning: Experience as the Source of Learning and Development', FT Press.

Kolb, DA 1981, 'Experiential Learning Theory and the Learning Style Inventory: A Reply to Freedman and Stumpf', The Academy of Management Review, vol. 6, p. 289. Doi: 10.2307/257885

Mumford, A 2006, 'The learning styles, Rev. ed. Peter Honey Publications Ltd., Maidenhead.

Nuryadi, N, Sukestiyarno, YL, Suyitno, H & Kharisudin, I 2022, 'Analisis Kemampuan Berpikir Kritis Ditinjau Dari Gender Dan Self-Efficacy Matematika Siswa Dalam Mengerjakan Soal Framework PISA', in: Prosiding Seminar Nasional Pascasarjana, pp. 846–855.

Palacios, M, S, Matus, O, Soto, A, Ibáñez, P & Fasce, HE 2006, 'Estilos de aprendizaje en Primer Año de Medicina según cuestionario Honey-Alonso: publicación preliminar', Revista de Educación en Ciencias de la Salud, vol. 3, p. 3.

Swailes, S & Senior, B 1999, 'The Dimensionality of Honey and Mumford's Learning Styles Questionnaire', International Journal of Selection and Assessment, vol. 7, pp. 1–11. Doi: 10.1111/1468-2389.00099

Trimurtini, Waluya, SB, Sukestiyarno, YL, Kharisudin, I, &. Nugraheni, N 2023, 'Scaffolding Guidelines in Geometry Learning for Learning Trajectory Optimization', B P International, pp. 20–37. Doi: 10.9734/bpi/pller/v3/8261A

Vermunt, JD 1996, 'Metacognitive, cognitive and affective aspects of learning styles and strategies: A phenomenographic analysis', High Educ., vol. 31, pp. 25–50. Doi: 10.1007/BF00129106

Wahyuningsih 2024, 'Pengaruh Gaya Belajar Honey dan Mumford Terhadap Kemampuan Berpikir Kritis Matematis', Presented at the Seminar Nasional Matematika, PRISMA, pp. 103–106.

Yadav, S, Kalra, R, Naeem, R, Verma, A, Gupta, R, Sarin, N & Singh, S 2020, 'Honey-Mumford's learning styles of medical laboratory students: An observational study with implications for laboratory efficiency', Arch. Med. Health Sci., vol. 8, p. 107. Doi: 10.4103/amhs.amhs_43_20