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https://doi.org/10.32728/mo.20.1.2025.01
Original scientific paper

ENHANCING THE TEACHING OF THE LAPLACE TRANSFORM THROUGH HONEY AND MUMFORD'S LEARNING STYLES: A CASE STUDY

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ABSTRACT

This study examines the learning style profiles of electrical engineering students using the Honey and Mumford Learning Styles Questionnaire (LSQ) and explores how these profiles may inform the teaching of the Laplace transform. Data were collected from 53 second-year undergraduate students enrolled in a mathematics course at the Faculty of Engineering, University of Rijeka. Several complementary statistical analyses were conducted, including descriptive analysis, Pareto analysis of combined learning-style profiles, hierarchical cluster analysis, and correlation analysis. The results indicate that reflective learning tendencies are dominant within the observed cohort, frequently combined with theoretical and pragmatic orientations. Based on these findings, the study proposes pedagogical guidelines for teaching the Laplace transform that emphasise conceptual explanation, analytical reflection, and structured application. The results suggest that understanding the structure of students' learning styles may support the development of more pedagogically coherent instructional strategies in engineering mathematics.

Keywords: learning styles, Honey and Mumford, Laplace transform, engineering mathematics education, cluster analysis

INTRODUCTION

In STEM education, instructors frequently face the challenge of designing teaching approaches that accommodate diverse student needs while ensuring the attainment of clearly defined learning outcomes. These considerations are particularly relevant in engineering mathematics, where students often encounter difficulties when moving from procedural manipulation of formulas toward deeper conceptual understanding of mathematical tools. One topic where this challenge becomes especially visible is the teaching of the Laplace transform, which students frequently approach as a purely computational technique rather than as a conceptual framework for analysing differential equations and linear systems.

One possible perspective for addressing such challenges involves considering differences in students' learning preferences. Researchers have noted that students tend to learn more effectively in environments that align with their preferred learning approaches (Li et al., 2008). From this perspective, identifying students' learning-style profiles can provide pedagogically useful insights, as awareness of these profiles may help both instructors and learners develop greater flexibility in their approaches to studying and teaching (Théberge & LeBlanc, 1998). At the same time, learning styles are generally understood to have descriptive rather than deterministic pedagogical value. For example, Shaw and Marlow (1999) show that Honey and Mumford learning styles help explain why some students perceive technology-based learning environments as less personal and interactive, while other studies indicate that awareness of learning-style differences can support the development of varied and balanced teaching strategies (Fleming et al., 2011).

Empirical research further demonstrates that Honey and Mumford's four-style framework, comprising Activist, Reflector, Theorist, and Pragmatist orientations, can be identified across different higher-education contexts. For instance, Penger and Tekavčič (2009) show that Honey and Mumford's framework can be empirically recovered through factor analysis among Slovenian higher-education students, supporting its applicability for analysing learning-style patterns. In engineering education contexts, Ozdemir et al. (2016) demonstrate that students and instructors exhibit identifiable learning-style profiles that may inform instructional alignment. Similar diversity in learning-style preferences has also been observed among undergraduate and postgraduate medical students, highlighting the need for varied instructional approaches (Shukr et al., 2013). Moreover, research indicates that learning-style profiles can evolve

as students gain practical experience, suggesting that these frameworks may provide a useful lens for understanding how educational environments shape the development of more adaptable learners (van den Berg, 2015).

A related line of research emphasises the role of learning-style awareness in supporting metacognitive development and learner autonomy. Studies indicate that familiarising students with their own learning-style profiles may help them recognise their strengths and weaknesses and adopt more effective learning strategies (Sharif et al., 2010). Broader institutional analyses also suggest that identifying dominant learning-style patterns across student populations may assist educators in designing teaching approaches that better align with learners' preferred modes of engagement (Maric et al., 2015; Jepsen et al., 2015). More recent research connects learning-style frameworks with data-informed instructional design. For example, Lang (2023) demonstrates that analysing online learning behaviour through the Honey and Mumford framework can reveal meaningful interaction patterns that support more personalised instructional strategies. Similarly, studies examining flipped-classroom environments indicate that aligning instructional design with learning-style characteristics may enhance student engagement and learning outcomes (Soler-Rovira et al., 2019).

In light of these insights, the present study examines the learning-style profiles of electrical engineering students using the Honey and Mumford framework. The goal is to explore how the identified learning-style structure may inform the redesign of instruction on the Laplace transform. By linking established research on learning styles with the specific didactic challenges of engineering mathematics, the study aims to contribute to the development of more pedagogically coherent and conceptually oriented approaches to teaching this topic.

The contribution of this case study is not theoretical advancement of the learning-styles framework, but its context-specific application to the teaching of the Laplace transform. The study does not test or endorse rigid matching between learning styles and instructional methods; the framework is used only as a descriptive basis for pedagogical reflection.

MATERIALS AND METHODS

Participants

The study was conducted among undergraduate students enrolled in the University Undergraduate Study Programme in Electrical Engineering at the Faculty of Engineering, University of Rijeka. Data were collected from students

attending the course Mathematics 3, which is taught in the second year of the programme and includes the Laplace transform as part of the curriculum. In total, 64 students were enrolled in the course, and 53 students participated in the study by completing the questionnaire. Participation was voluntary and responses were collected anonymously during regular course activities.

Instrument

Students' learning-style preferences were assessed using the Honey and Mumford Learning Styles Questionnaire (LSQ) (Honey & Mumford, 2006). The LSQ is based on Kolb's experiential learning theory (Kolb, 1984) and identifies four learning styles: Activist, Reflector, Theorist, and Pragmatist.

The questionnaire consists of 80 statements, with 20 items associated with each learning style. Students indicate whether they agree or disagree with each statement. Scores for each learning style are obtained by summing the number of statements with which the respondent agrees. The resulting scores are interpreted using the preference bands provided in the LSQ manual (Honey & Mumford, 2006).

Statistical Analysis

Several complementary statistical procedures were used to analyse the collected data. First, descriptive statistics were used to examine the distribution of learning-style preferences across the four Honey and Mumford dimensions. Raw LSQ scores were analysed using graphical visualisations to illustrate the variability and central tendencies of each learning style within the cohort. Second, the distribution of combined dominant learning-style profiles was examined using Pareto analysis, allowing the identification of the most frequent style combinations within the student group.

To explore the latent structure of learning-style preferences, an exploratory hierarchical cluster analysis was conducted on the raw LSQ scores (Arow, Rrow, Trow, and Prow). The analysis was performed using Euclidean distance and Ward's linkage method, with variables standardised prior to clustering. The optimal number of clusters was determined using the Bayesian Information Criterion (BIC). Finally, the relationships among the four learning-style dimensions were examined using Pearson correlation coefficients, providing additional insight into the structural relationships between the Honey and Mumford learning styles.

Ethical Considerations

Participation in the study was voluntary and all responses were collected anonymously. The questionnaire was administered for research purposes related to improving teaching practices, and no personally identifiable information was collected from participants.

RESULTS

Structure of Learning Styles in the Observed Student Cohort

Using the Honey and Mumford Learning Styles Questionnaire, students' learning patterns were analysed. The aim of this analysis was to determine the distribution of learning styles and to describe their mutual structure within the observed group.

Average Learning Style Profile

The interpretation of learning style preferences was performed using the preference bands defined in the Honey and Mumford Learning Styles Questionnaire manual (Honey & Mumford, 2006). These bands classify results into five levels of preference: very low, low, moderate, strong, and very strong.

Figure 1 presents the distribution of students' responses across five preference categories derived from the Honey and Mumford preference bands (very low, low, moderate, strong, and very strong) for items associated with the four learning styles: Activist (A), Reflector (R), Theorist (T), and Pragmatist (P). The results indicate that the Reflector style exhibits the strongest tendency toward agreement, with approximately 79% of responses falling into the positive categories (4 - 5). This is followed by the Activist style (66%), while the Theorist (57%) and Pragmatist (51%) styles show comparatively lower levels of agreement.

At the group level, these results suggest that reflective learning characteristics are the most prominent within the observed cohort, followed by activist tendencies, whereas theorist and pragmatist orientations appear less strongly expressed.

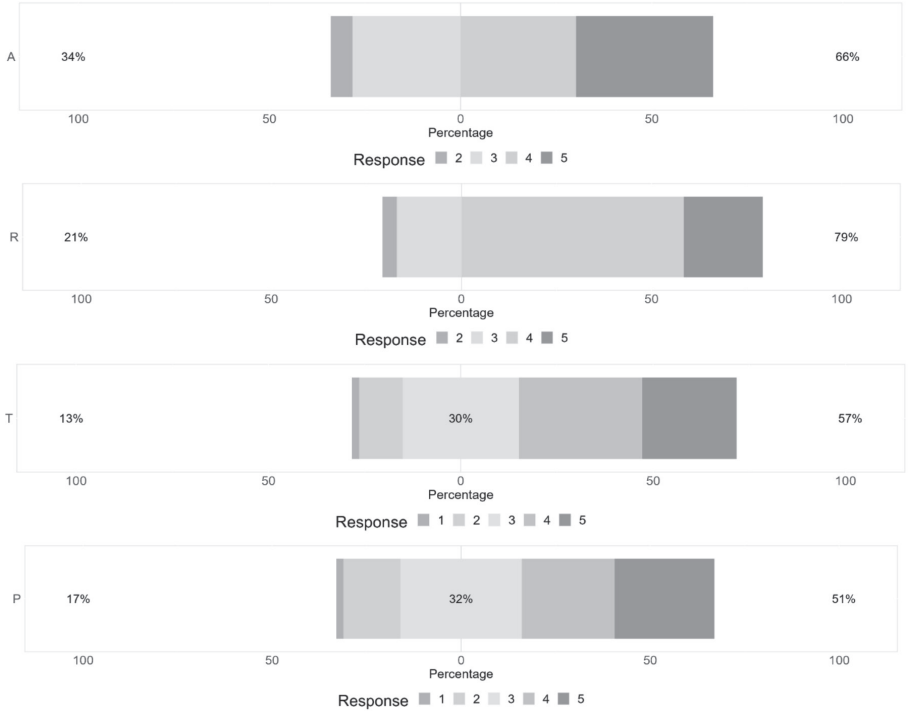


Figure 1. Distribution of students' responses across Honey and Mumford learning styles.

While Figure 1 illustrates the distribution of responses across Likert categories, Figure 2 complements this view by presenting the distribution of raw Honey and Mumford learning style scores. The boxplot representation allows a clearer comparison of median values and variability across the four learning styles within the observed cohort.

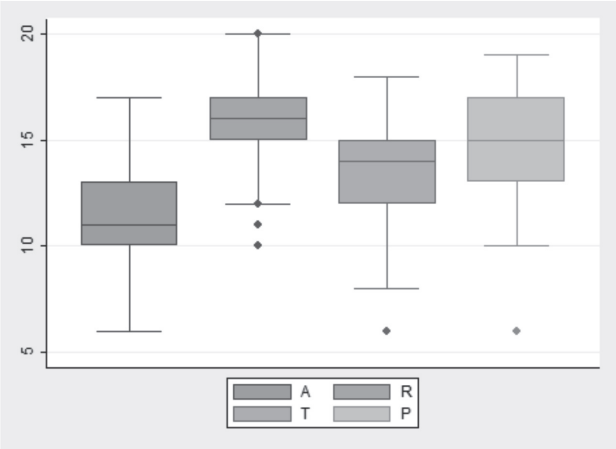


Figure 2. Distribution of raw Honey and Mumford learning style scores.

The boxplot representation provides a detailed view of the distribution of raw scores for the four Honey and Mumford learning styles: Activist (A), Reflector (R), Theorist (T), and Pragmatist (P). The Reflector style exhibits the highest median score among the four styles, indicating that reflective learning tendencies are the most pronounced within the observed cohort. The Theorist and Pragmatist styles show moderately high median values with relatively similar distributions, whereas the Activist style displays the lowest median score and a somewhat wider dispersion of values. These results reinforce the pattern observed in Figure 1. While the previous figure highlighted the predominance of positive responses associated with the Reflector style, the distribution of raw scores shown here confirms the same tendency at the level of individual LSQ scores. Both representations therefore consistently indicate that reflective learning characteristics are the most prominent within the analysed student cohort.

To identify combined dominant learning styles, a two-step classification procedure was applied. First, learning styles reaching the Honey and Mumford strong preference threshold were identified ($A \geq 13$, $R \geq 18$, $T \geq 16$, $P \geq 17$). If exactly two styles met these criteria, they were taken as the dominant combination. If more than two styles reached the threshold, the two highest raw scores among them were selected. If only one style reached the strong preference threshold, it was paired with the highest raw score among the remaining styles. If no style reached the strong preference threshold, the two highest raw scores overall were used to define the combined profile. In cases where equal raw scores

occurred, ties were first resolved using the Likert preference values. If the tie persisted, a fixed priority order based on the observed distribution of styles in the sample (R > T > P > A) was applied to ensure a unique classification.

Applying this classification procedure, each student was assigned a combined dominant learning style consisting of two styles. The resulting combinations were then aggregated to examine the distribution of learning style profiles within the observed cohort. Six possible combinations were considered: Reflector-Activist (RA), Reflector-Theorist (RT), Reflector-Pragmatist (RP), Activist-Theorist (AT), Activist-Pragmatist (AP), and Pragmatist-Theorist (PT).

The frequency of each combination was subsequently analysed in order to identify the most prevalent learning style profiles among the students. To highlight the relative importance of these combinations and their cumulative contribution to the overall distribution, the results are presented using a Pareto chart in Figure 3.

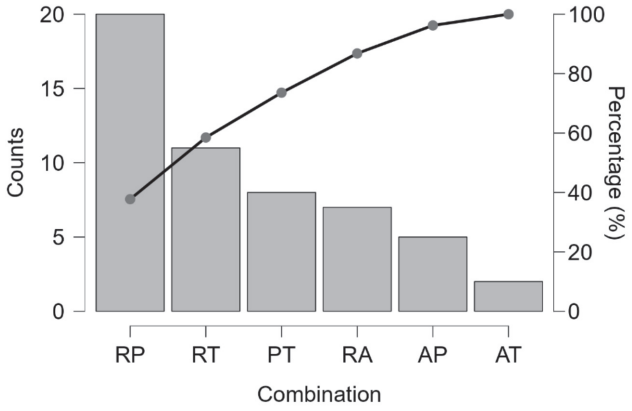


Figure 3. Pareto distribution of combined dominant learning style profiles.

The Pareto chart reveals a clear dominance of a small number of learning style combinations within the cohort. The Reflector-Pragmatist (RP) profile is the most frequent, occurring in 20 students (37.7%), followed by the Reflector-Theorist (RT) combination with 11 students (20.8%). Together, these two profiles account for 31 students, representing 58.5% of the sample. The Pragmatist-Theorist (PT) and Reflector-Activist (RA) combinations occur less frequently, with 8 students (15.1%) and 7 students (13.2%) respectively. The remaining profiles, Activist-Pragmatist (AP) and Activist-Theorist (AT), appear only sporadically in the cohort, representing 5 students (9.4%) and 2 students (3.8%).

Overall, the three most frequent combinations (RP, RT, and PT) together account for 39 students, or 73.6% of the observed cohort. This distribution further supports the earlier findings indicating that reflective learning tendencies play a central role in the learning style structure of the analysed student group.

Cluster-Based Identification of Learning Style Profiles

To further examine the structure of learning style preferences within the observed cohort, an exploratory hierarchical cluster analysis was conducted on the raw LSQ scores. The analysis was performed using Euclidean distance and Ward's linkage method, with variables standardised prior to clustering. The optimal number of clusters was determined using the Bayesian Information Criterion (BIC). For comparison, the Akaike Information Criterion (AIC) and the within-cluster sum of squares (WSS) were also inspected across different cluster solutions. As shown in Figure 4, the BIC reaches its minimum for a three-cluster solution (indicated by the red marker), suggesting that this model provides the best balance between goodness of fit and model parsimony.

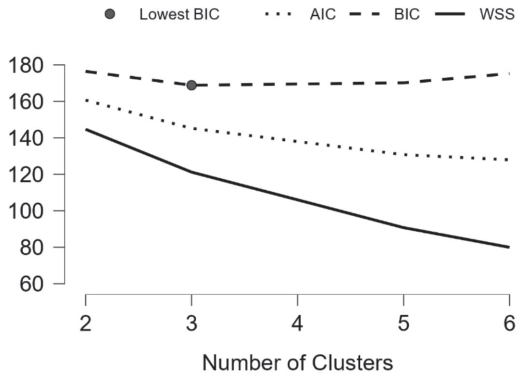


Figure 4. Determination of the optimal number of clusters using BIC and WSS criteria.

Based on this criterion, a three-cluster solution was selected for further interpretation. The resulting clusters comprised 27, 12, and 14 students, respectively. The overall silhouette coefficient of the solution was 0.170, indicating a moderate separation between clusters. In addition, the Calinski-Harabasz index reached a value of 17.907, supporting the presence of a meaningful cluster structure in the data. The distributions of Activist, Reflector, Theorist, and Pragmatist scores within each cluster are presented in Figure 5. The boxplots illustrate both the central tendency and the variability of learning style scores

within each cluster, allowing a clearer comparison of learning style profiles across the identified groups.

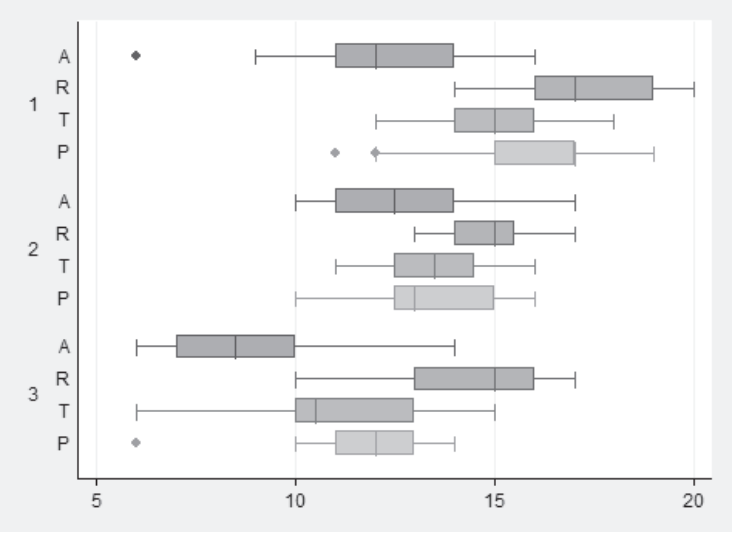


Figure 5. Distribution of Honey and Mumford learning style scores across clusters.

The first cluster (n = 27) is characterised by above-average scores relative to the sample in the Reflector and Pragmatist dimensions, accompanied by moderately elevated Theorist scores. This pattern suggests a learning orientation that combines reflective observation with analytical processing and practical application.

The second cluster (n = 12) shows above-average scores relative to the sample in the Activist dimension, while the remaining dimensions are comparatively lower. This profile indicates a more action-oriented learning approach.

The third cluster (n = 14) exhibits below-average scores relative to the sample across all four learning style dimensions, suggesting a more balanced profile without strongly pronounced learning style preferences.

Taken together, the cluster structure closely reflects the distribution of dominant learning style combinations identified earlier. In particular, the largest cluster corresponds to profiles that combine reflective tendencies with either pragmatic or theoretical orientations, which is consistent with the predominance of RP and RT combinations observed in the Pareto analysis. This convergence of results across multiple analytical approaches further confirms the central role of reflective learning tendencies in the overall learning style structure of the analysed student cohort.

Correlation Structure of Learning Style Dimensions

To better understand the relationships among the four Honey and Mumford learning style dimensions and to further interpret the patterns observed in the previous analyses, a correlation analysis of LSQ scores was conducted. The correlation matrix is presented in Figure 6.

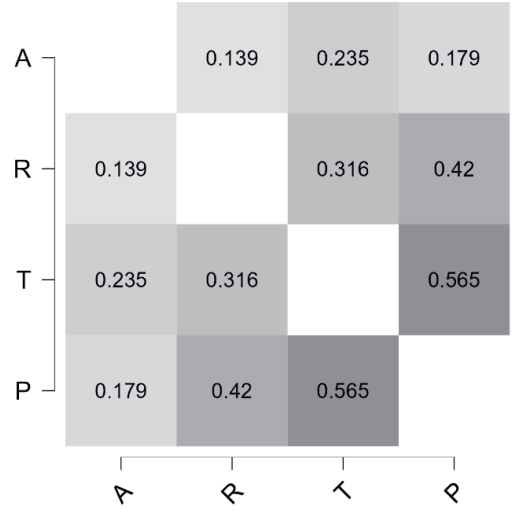


Figure 6. Correlation matrix of Honey and Mumford learning style scores.

The results reveal several moderate positive associations between learning style dimensions. The strongest correlation was observed between the Theorist and Pragmatist styles (r = 0.565), indicating that students who demonstrate stronger analytical tendencies also tend to prefer the practical application of ideas. Moderate correlations were also found between the Reflector and Pragmatist (r = 0.420) and between the Reflector and Theorist (r = 0.316) styles, suggesting that reflective learning tendencies frequently co-occur with analytical and application-oriented approaches.

In contrast, the Activist style exhibits relatively weak correlations with the other learning styles (r ranging from 0.139 to 0.235), indicating that this dimension represents a more distinct orientation within the observed cohort.

Overall, the correlation structure supports the patterns identified in the previous analyses. In particular, the relatively strong associations between Reflector, Theorist, and Pragmatist dimensions provide a structural explanation for the predominance of learning style combinations involving reflective

components (e.g., RP and RT) identified earlier in the Pareto analysis and cluster-based profiling.

Synthesis of Learning Style Analysis

The analyses conducted in this study provide a consistent picture of the learning style structure within the observed cohort. Across several complementary analytical approaches, reflective learning tendencies emerged as the most prominent component of students' learning profiles. The distribution of Likert responses and raw LSQ scores indicated that the Reflector dimension shows the highest typical values within the group. This pattern was further supported by the analysis of dominant learning style combinations, where profiles including a reflective component, particularly the Reflector-Pragmatist (RP) and Reflector-Theorist (RT) profiles, were found to be the most frequent. The hierarchical cluster analysis confirmed this tendency by identifying a large cluster characterized by above-average scores in the Reflector dimension together with elevated Pragmatist and Theorist scores. In contrast, the Activist dimension appears less integrated into the dominant learning style profiles. Activist tendencies were relatively weakly correlated with the other styles and formed a smaller cluster characterised by a more action-oriented learning approach.

Overall, these results indicate that the learning style structure of the analysed student cohort is primarily centred around reflective learning tendencies, which frequently appear in combination with theoretical reasoning and practical application, while activist tendencies represent a more distinct and less prevalent orientation within the group. This overall pattern provides an important basis for interpreting the pedagogical implications of the findings, which are discussed in the following section.

Pedagogical Implications of the Observed Learning Style Structure

The results of the statistical analyses provide a basis for deriving several pedagogical implications. The observed structure of learning style preferences suggests that certain instructional approaches may be more compatible with students' dominant learning tendencies than others. Rather than prescribing rigid teaching rules, the following implications are presented as practical guidelines for designing learning activities that align with the learning style structure identified in the analysed cohort. Table 1 summarises instructional

approaches according to their degree of alignment with the observed learning style preferences.

Table 1. Pedagogical implications based on the observed learning style structure

Category	Pedagogical approaches
Approaches strongly aligned with the observed learning style structure	Structured problem solving; analytical explanations followed by practical application; worked examples before independent practice; reflective discussion of solution strategies; step-by-step modelling of problem-solving procedures
Approaches with neutral alignment	Traditional lectures; guided practice sessions; instructor-led demonstrations; standard exercise sessions; structured group work with clear roles
Approaches requiring careful implementation	Highly exploratory activities without guidance; discovery learning without prior conceptual explanation; rapid brainstorming tasks; open-ended tasks without scaffolding
Approaches that should generally be avoided	Activities relying primarily on spontaneous action; tasks requiring immediate responses without preparation; strongly improvisational learning situations; trial-and-error learning without conceptual framing

Interpretation of the Pedagogical Implications

The predominance of Reflector tendencies observed in the cohort suggests that students benefit from instructional approaches that allow time for reflection, analysis, and structured reasoning before engaging in practical application. This interpretation is consistent with the relatively high Theorist and Pragmatist scores observed in the LSQ results, the predominance of RP and RT learning style combinations, and the cluster structure characterised by elevated Reflector scores. Consequently, instructional designs that integrate conceptual explanation with structured opportunities for application appear particularly well suited for this student group. Teaching strategies such as worked examples, guided problem solving, and reflective discussion of solution procedures allow students to connect theoretical understanding with practical implementation while maintaining sufficient time for analysis and reflection.

Instructional approaches based on unstructured exploration or rapid experimentation should be implemented with caution. Reflector-dominant learners typically require time to observe, analyse, and organise information before actively engaging in tasks. Activities that demand immediate responses or rely heavily on improvisation may therefore create unnecessary cognitive

pressure and reduce learning effectiveness if they are not supported by adequate conceptual scaffolding. Finally, the relatively weak presence of the Activist dimension in the analysed cohort suggests that strongly action-oriented learning environments are unlikely to match the dominant learning tendencies of most students. For this reason, learning activities based primarily on spontaneous action or trial-and-error approaches without conceptual grounding should generally be avoided or carefully balanced with reflective and analytical components.

Pedagogical Implications for Teaching the Laplace Transform

The learning style structure identified in this study suggests several implications for the teaching of the Laplace transform. The analysed cohort exhibits a pronounced Reflector component together with elevated Theorist and Pragmatist tendencies. Such a profile indicates that students benefit from instructional approaches that combine conceptual explanation, analytical reflection, and structured application. In the context of teaching the Laplace transform, this suggests that instruction should emphasise the conceptual meaning of the transform before focusing on procedural computation. Students may benefit from analysing the role of the Laplace transform as a mathematical tool that converts differential equations into algebraic expressions in a new representation domain. Introducing the transform through its mathematical motivation and structural interpretation can support deeper understanding than approaches that begin directly with transform tables and computational procedures.

The presence of strong Theorist tendencies further supports instructional approaches that highlight the internal mathematical structure of the transform. For instance, discussing the relationship between differential operators and algebraic manipulation in the transform domain or examining the role of exponential kernels can help students connect computational techniques with their theoretical foundations. The Pragmatist component observed in the cohort suggests that conceptual explanations should be followed by carefully structured application. Worked examples, guided problem solving, and gradually increasing levels of independent problem solving allow students to connect theoretical understanding with practical procedures for solving differential equations.

These findings also have implications for the use of contemporary instructional approaches such as the flipped classroom, team-based learning, and project-based learning. In the case of the flipped classroom model, the

results suggest that pre-class materials should focus primarily on conceptual explanations rather than procedural demonstrations. If pre-class learning materials consist mainly of worked examples or computational techniques, students may not develop the conceptual framework needed for meaningful in-class activities. Team-based learning can support reflective and analytical learning processes if tasks are designed to encourage discussion of conceptual reasoning and solution strategies. However, group activities that prioritise rapid problem solving without sufficient time for analysis may not align well with the reflective tendencies observed in the cohort. Similarly, project-based learning can be beneficial when projects emphasise the interpretation and application of mathematical ideas, such as modelling physical systems using differential equations and Laplace transforms. In contrast, projects that focus primarily on procedural computation without encouraging conceptual reflection may offer limited pedagogical benefit.

Key Instructional Recommendations

Based on the results of this study, several instructional practices appear particularly suitable for teaching the Laplace transform:

- introducing the conceptual motivation of the transform before procedural techniques
- emphasising the interpretation of the transform as a mapping between mathematical representations
- using worked examples that connect conceptual reasoning with computational procedures
- allowing time for analytical reflection before independent problem solving.

Conversely, certain practices should be avoided as dominant instructional strategies:

- presenting transform tables before explaining the conceptual meaning of the transform
- emphasising memorisation of transform pairs without discussing their mathematical origin
- focusing primarily on procedural manipulation of formulas
- designing learning activities that prioritise rapid solution of tasks over conceptual analysis.

Taken as a whole, these observations suggest that effective teaching of the Laplace transform should integrate conceptual explanation, reflective analysis,

and structured application. Such an approach appears to align well with the learning style structure identified in this study and may therefore support a deeper understanding of the transform as a mathematical tool rather than merely a computational technique.

DISCUSSION

The purpose of this study was to analyse the learning-style structure of electrical engineering students using the Honey and Mumford framework and to derive pedagogical guidelines for teaching mathematically demanding topics such as the Laplace transform. The results indicate a learning profile dominated by Reflector tendencies, accompanied by relatively strong Theorist and Pragmatist components, while the Activist dimension appears less pronounced.

This pattern is broadly consistent with previous research on learning styles in higher education. Studies conducted among university students often report mixed learning-style profiles in which reflective and analytical orientations play a central role (Penger & Tekavčič, 2009; Maric et al., 2015). Similar diversity in learning-style preferences has also been documented in other disciplinary contexts, including medical and nursing education (Shukr et al., 2013; Fleming et al., 2011). These findings support the interpretation that learning styles rarely appear as isolated dominant traits but rather as combinations of several learning tendencies that shape how students approach learning tasks.

The observed learning-style structure can also be interpreted through Kolb's experiential learning cycle (Kolb, 1984), which conceptualises learning as a process involving concrete experience, reflective observation, abstract conceptualisation, and active experimentation. The prominence of Reflector and Theorist tendencies identified in this study suggests that students rely strongly on reflective observation and abstract conceptualisation when engaging with complex mathematical material. At the same time, the presence of a Pragmatist component indicates the importance of linking conceptual reasoning with practical application. This combination of reflection, conceptual analysis, and application appears particularly relevant for learning mathematically structured topics such as the Laplace transform.

The predominance of reflective tendencies may partly reflect the institutional and disciplinary context of the observed cohort. Students had already been exposed to a structured engineering curriculum in which analytical reasoning, guided problem solving, and careful verification of procedures are strongly emphasised. Such educational practices may encourage reflective and theoretical

learning preferences. However, institutional and cultural influences were not directly examined in this study, so this interpretation remains tentative.

The findings also align with research showing that learning-style profiles may influence how students perceive and engage with different instructional approaches (Shaw & Marlow, 1999; Jepsen et al., 2015). In engineering mathematics, this insight is especially important because students often approach topics such as the Laplace transform procedurally, focusing on the manipulation of transform tables rather than on the underlying mathematical ideas. The present results suggest that instructional strategies emphasising conceptual explanation followed by structured application may better support the learning preferences observed in this cohort.

These observations are also relevant for the implementation of contemporary instructional approaches in engineering education. Teaching models such as the flipped classroom, team-based learning, and project-based learning are increasingly used to promote active learning. However, the present findings suggest that the effectiveness of such approaches may depend on how they are implemented. For example, flipped-classroom models may be most effective when pre-class materials emphasise conceptual explanation rather than purely procedural demonstrations, while in-class activities may focus on guided analysis and collaborative problem solving. Similarly, team-based activities can support reflective learning when tasks are designed to encourage discussion of mathematical reasoning rather than simply rapid problem solving.

At the same time, it is important to interpret learning-style findings with appropriate caution. Although learning-style frameworks can provide useful descriptive insights into how students approach learning tasks, systematic reviews have questioned the strength of evidence supporting strict "matching" between learning styles and instructional methods (Pashler et al., 2008; Coffield et al., 2004). Consequently, the results of the present study should not be interpreted as support for rigid style-based instructional differentiation. Instead, the identified learning-style structure is understood as a descriptive framework that can inform pedagogical reflection and support the design of more balanced teaching approaches.

Several limitations of the study should also be acknowledged. As a single-cohort case study, the research was intended to provide a context-sensitive analysis rather than population-level generalisation. The findings are therefore specific to the observed institutional setting. Second, the analysis is based on self-reported learning-style preferences obtained through the LSQ questionnaire, which reflect perceived learning tendencies rather than directly observed

learning behaviour. The cluster-based findings should also be understood as exploratory descriptive patterns within the observed cohort rather than as stable student typologies. Finally, the study focuses on the structure of learning-style preferences rather than directly measuring the impact of different teaching strategies on learning outcomes.

Future research could complement questionnaire data with behavioural indicators such as classroom observations, LMS activity, or records of students' problem-solving processes. Comparative or quasi-experimental studies could also examine whether the proposed instructional approaches contribute to conceptual understanding, procedural performance, retention, or transfer, while studies across additional cohorts and institutions could assess the transferability of the observed patterns.

Overall, the findings suggest that analysing learning-style structures can provide useful insights for designing teaching approaches that support students' engagement with mathematically demanding topics. When interpreted cautiously and used as a descriptive rather than prescriptive framework, the Honey and Mumford learning-style model may therefore contribute to the development of more pedagogically informed strategies for teaching engineering mathematics.

CONCLUSION

This study analysed the learning style structure of electrical engineering students using the Honey and Mumford framework and examined how these findings can inform the teaching of the Laplace transform. The results indicate that reflective learning tendencies play a central role in the observed cohort, frequently appearing in combination with theoretical reasoning and pragmatic application. The analysis suggests that instructional approaches integrating conceptual explanation, analytical reflection, and structured application may be particularly effective for this student group. In the context of teaching the Laplace transform, such approaches may help shift students' focus from purely procedural manipulation of formulas toward a deeper conceptual understanding of the transform as a mathematical tool.

While learning styles should not be interpreted as rigid prescriptions for instructional design, the results demonstrate that analysing learning-style structures can provide useful insights for developing pedagogically coherent teaching strategies in engineering mathematics.

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UNAPRJEĐENJE NASTAVE IZ PODRUČJA LAPLACEOVIH TRANSFORMACIJA KROZ STILOVE UČENJA PREMA HONEYJU I MUMFORDU: STUDIJA SLUČAJA

Ovaj rad analizira strukturu stilova učenja studenata elektrotehnike koristeći Honey i Mumford Learning Styles Questionnaire (LSQ) te ispituje kako dobiveni rezultati mogu doprinijeti unapređenju nastave Laplaceove transformacije. Podaci su prikupljeni od 53 studenta druge godine prijediplomskog studija elektrotehnike na kolegiju Matematika 3 na Tehničkom fakultetu Sveučilišta u Rijeci. Provedeno je nekoliko komplementarnih statističkih analiza, uključujući deskriptivnu analizu, Pareto analizu kombinacija stilova učenja, hijerarhijsku klastersku analizu i korelacijsku analizu. Rezultati pokazuju da u promatranoj skupini dominiraju refleksivne tendencije učenja, često u kombinaciji s teorijskim i pragmatičnim pristupom. Na temelju dobivenih nalaza predlažu se pedagoške smjernice za poučavanje Laplaceove transformacije koje naglašavaju konceptualno objašnjenje, analitičku refleksiju i strukturiranu primjenu.

Ključne riječi: stilovi učenja, Honey i Mumford, Laplaceova transformacija, nastava matematike u inženjerstvu, klasterska analiza