

PRESS RELEASE

THInkPen, a “Smart” Pen for Early Screening of Dysgraphia: Study by Politecnico di Milano and the University of Insubria Published

THInkPen, a sensorized pen that writes on paper, tested on more than 700 children to assess the entire writing process and identify writing difficulties

Milan, 07 September 2026 – A patented sensorized pen for the early screening of writing difficulties. **A study by Politecnico di Milano and the University of Insubria (Varese and Como) has been published, involving more than 700 children from across the entire primary and lower secondary school cycle.** The participants **used the THInkPen (Tele-Health Ink Pen)** while completing two BVSCO-3 tasks, the Battery for the Clinical Assessment of Writing and Orthographic Skills. This is the most widely used test in Italy for assessing writing difficulties, dysgraphia and dysorthography.

Its innovative feature is that **the sensorized ink pen enriches the information provided by clinical tests**, as required by the latest approved guidelines on Specific Learning Disorders, while **allowing users to write on paper just like with a standard pen**. This represents **a substantial difference compared with other screening tools**, such as tablets. Its use during testing made it possible to **highlight relevant characteristics of children's writing process** and to provide a large amount of detailed information. From the data collected, **digital indicators** related to different aspects of writing were computed, such as the pressure on the paper, movement fluency, pen inclination and the frequency of the signals transmitted to the device through its sensors. The collected data were subsequently analyzed to assess their correlation with clinical scores, model their progression across school grades and identify their usefulness in detecting writing difficulties through the Artificial Intelligence algorithms that were developed for this task.

The results revealed significant and consistent relationships between the digital indicators and the clinical scores, confirming the ability of these indicators to reliably reflect performance characteristics. **Binary classification AI models successfully distinguished students with writing difficulties** (identified on the basis of their BVSCO-3 results) **from the other students**, while Explainable Artificial Intelligence (XAI) techniques made it possible to identify the reasons underlying below-average performance, paving the way for targeted interventions.

The statistical analysis across school grades also showed that the digital indicators faithfully reproduced the well-established pattern of improvement in writing observed from one grade to the next, demonstrating their sensitivity in capturing the development of graphomotor skills.

The study stems from the PRIN research project “e-School 2.0”, **coordinated by the Department of Electronics, Information and Bioengineering – DEIB at Politecnico di Milano, in collaboration with the University of Insubria.** «**The use of THInkPen to analyse not only the final written product, but the entire writing process, could support the early identification of writing difficulties in schools**, thus facilitating the timely and effective activation of clinical services»,

explains **Simona Ferrante, Professor at DEIB** and coordinator of the Politecnico di Milano research team.

«This aspect is particularly relevant in light of the growing demand that Child and Adolescent Neuropsychiatry services face on a daily basis, and the resulting long waiting lists», adds **Dr Cristiano Termine, Professor of Child Neuropsychiatry at the University of Insubria**. «School difficulties are one of the main reasons why children are referred for assessment by these services, but **not all the difficulties experienced by students necessarily require specialist clinical evaluation. It therefore becomes essential to have reliable observation and screening tools that can help schools** better understand the nature of these difficulties and identify at an earlier stage those situations that genuinely require referral to Child and Adolescent Neuropsychiatry services».

The THInkPen project – patented by Politecnico di Milano together with the **University of Milan**, in collaboration with Professor **Alberto Borghese** – was initially conceived for the screening of neurodegenerative diseases and was subsequently developed for neurodevelopmental assessment. **Linda Greta Dui**, researcher at DEIB and recipient of the *Tecnovisionaria 2025 Award* on this topic, also contributed to this development.

This publication also involved **Cesare Cornoldi**, Professor Emeritus at **the University of Padua** and one of the developers of the BVSCO-3, **ASST Sette Laghi**, and the **Neuroscience Centre of Los Madroños Hospital** in Madrid.

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