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A tool to support mathematical thinking during problem solving



A study by UAB researchers presents the Non-Linear Orientation Base (N LOB), a flexible tool that helps sixth-grade primary school students regulate their mathematical thinking while solving problems. The research shows that building and revising this tool fosters reflection, the use of more efficient strategies and a better understanding of students' own problem-solving processes.

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In recent years, research in mathematics education has highlighted the importance of metacognition (that is, thinking about how we think) during problem solving. For this reason, in a recent study we set out to better understand how sixth-grade primary students manage these metacognitive processes and, above all, how we can help them do so in a more conscious and efficient way.

To address this, we conceptualised a tool called the Non-Linear Orientation Base (N-LOB). This instrument is built and progressively modified by the students themselves as they solve different problems. Unlike other more rigid tools, the N-LOB does not follow a fixed sequence: it allows students to move forward, step back, or reorganise their ideas depending on what they discover.

To conceptualise and test the instrument, we worked with three sixth-grade groups from two

schools with different experiences in problem solving. The students solved several mathematical pattern problems and, afterwards, they shared their metacognitive processes (strategies, reflections, use of concepts or procedures) as a group. This process, combined with reflective peer assessment, enabled them to create a first version of their Non-Linear Orientation Base. The iterative cycle of solving, reflecting, and peer evaluating allowed them to improve their N-LOB step by step and, consequently, deepen their own metacognitive processes. For us as researchers, this iterative work enabled us to observe how students' decisions evolved, how they checked their results, and how they began to identify more efficient strategies.

The results showed that, at the beginning, the processes identified by the students were very general (reading the statement carefully, highlighting data, etc.). However, over time they began to include elements related to the specific content of the problem: recognising patterns, choosing more useful representations, changing strategy when the first approach did not work, or checking whether their drawings truly followed the logic of the situation. This evolution indicates that building and revising the N-LOB helps students become more aware of what they do and what they need to do when facing a complex problem. We also observed that this process fosters rich peer discussions and encourages the incorporation of new ways of thinking inspired by classmates' ideas.

In conclusion, we believe that the N-LOB is a powerful tool for promoting the regulation of one's own thinking during problem solving. Moreover, its flexible nature makes it adaptable to mathematical content beyond patterns. This opens the door to new research and potential applications in areas such as problem posing or work with tasks that require adaptive strategies.

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References

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