Investigating the suitability of Gestalt Principles for enhancing conceptual understanding of Newton's Laws among year 10 Physics students: A case study

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Newton's Laws of Motion are central to understanding physical interactions, yet students often struggle to develop a clear conceptual grasp, particularly of Newton's Third Law. Common misconceptions include the belief that larger objects exert greater forces and that action–reaction forces do not occur simultaneously. Traditional instruction, with its emphasis on mathematical problem-solving, often reinforces these difficulties. This study investigated the use of Gestalt principles—such as proximity, continuity, and symmetry—as a pedagogical tool to improve students' interpretation of force diagrams. The intervention involved 30 grade ten students in an international school, identified through diagnostic testing as holding common misconceptions. Lessons explicitly integrated Gestalt principles into the construction and analysis of force diagrams to promote holistic visualization of Newton's Laws. A mixed-methods approach was adopted. Quantitative data were obtained from pre- and post-tests using a standardized conceptual assessment, while qualitative data were derived from students' written explanations, classroom observations, and analyses of their force diagrams. Test scores showed a modest improvement (mean rising from 6.40 to 6.80), though this was not statistically significant, likely due to the small sample size. In contrast, qualitative findings revealed notable conceptual progress: 70% of students produced more accurate force diagrams, 40% improved in identifying action–reaction pairs, and many reported Gestalt-based visuals as more intuitive than traditional diagrams. Challenges remained with complex scenarios, indicating that visual strategies alone cannot fully resolve entrenched misconceptions. The study concludes that Gestalt principles provide a valuable framework for enhancing visualization and engagement in physics education. Their effectiveness is maximized when combined with other instructional strategies, such as conceptual scaffolding, interactive learning, and guided reasoning, to support deeper understanding of Newtonian mechanics.

Keywords: *Newton's Laws, Conceptual understanding, Gestalt Principles, Physics Education, Force diagrams*