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Why Do Students Distinguish Between Net Force and Total Force?

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**Abstract content (Max 300 words)
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In previous research we have shown that novice physics students distinguish between the concept of a net vector quantity and the concept of a total vector quantity. Introductory physics textbooks variably use the terms “net”, “total” or “resultant” when referring to a vector sum, with some textbooks using these terms interchangeably. In particular, we have shown that students distinguish between the concepts of net force and total force, and the concepts of net momentum and total momentum. Phase two of this research has been to analyse the reasons students give for making these distinctions. Using an approach suggested by Grounded Theory, free responses from 400 first year students have been analyzed and broad trends of reasoning have been identified. These trends are contrasted with foundational representational schemas posited by the cognitive sciences, such as “changing position versus changing state”, and “interior viewpoint versus exterior viewpoint”.

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