Erratum: Force Concept Inventory-based multiple-choice test for investigating students' representational consistency [Phys. Rev. ST Phys. Educ. Res. 6, 020109 (2010)]

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In our paper published recently in this journal, we presented the rationale and structure of the Representational Variant of the Force Concept Inventory (R-FCI). For this purpose we analyzed high school students' ($n = 168$) pre- and post-test data. Most of the students ($n = 143$) studied in Finnish and took the R-FCI pre- and post-test in Finnish too. One student group (Pre-IB, $n = 25$, 15% of all students) studied in English and took the Finnish R-FCI pretest and the English post-test. We found a difference between the English and Finnish test versions: the order of the alternatives was different for items 18 and 20. Because we had developed the analyzing system for the Finnish version of the R-FCI, this difference caused some errors in the R-FCI post-test results.

The errors are mostly minor (1-2 percentage points) and they are irrelevant to the aim of the published paper, i.e., presenting the R-FCI. However, the errors related to the distribution of correct answers for items 18 and 20 have some relevance in our paper. Item 18 is a vectorial item of theme 30 concerning gravitation, and item 20 is a vectorial item of theme 4 concerning Newton's third law. We reported that 57% of students correctly answered item 18, and 83% correctly answered item 20. The correct figures are 67% and 94%, respectively. This caused an error in Fig. 6 and Table V in the published article and induced a faulty result—a statistically significant effect of a representational format in themes 4 and 30 (see details in Section II C). This is not true. The corrected Fig. 6 and Table V show that students did not perform significantly worse with the vectorial than with the other representations in themes 4 and 30 in the post-test.

Most of the errors are minor, and the notable ones are related to the distribution of correct answers for two items. Hence, we conclude that despite these errors the published article still fulfills its main purpose: to describe the structure, rationale and validity of the R-FCI.
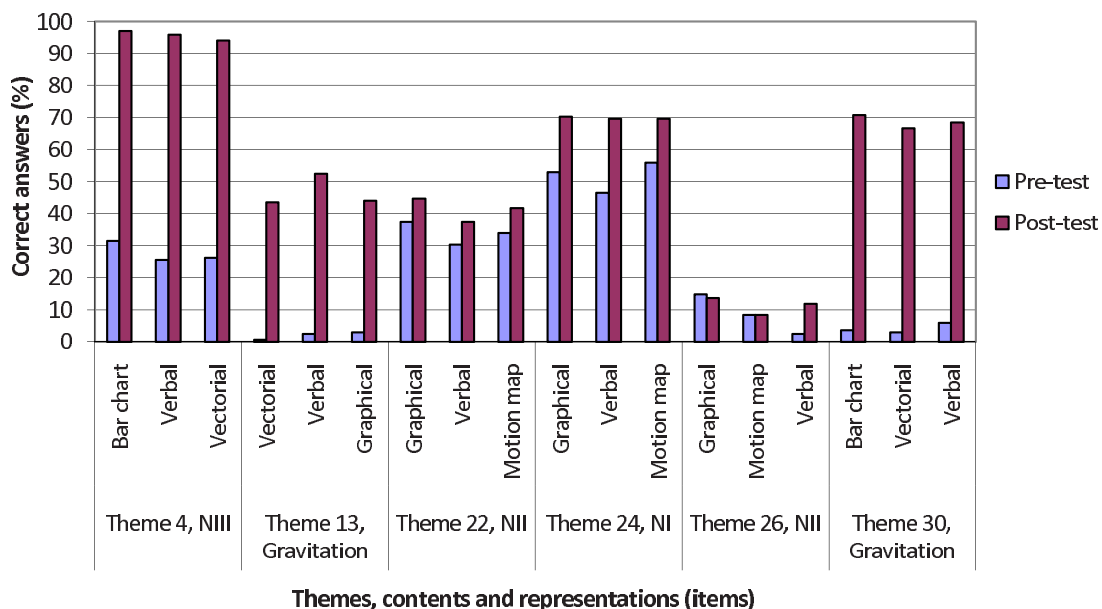

FIG. 6. (Color) The percentages of correct answers in the themes with statistically significant differences between representations.

TABLE V. Statistically significant differences ($p < 0.05$) between correct answers of items (representations) in themes (McNemar's test). Abbreviations: BC=bar chart, Ver=verbal, Vec=vectorial, G =graphical, MM=motion map, (ns)=non-significant.

Theme		Compared representations	p-value
T4	Pretest	BC vs. Ver	0.021
		BC vs. Vec	0.049
	Post-test	BC vs. Vec	0.125 (ns)
		Ver vs. Vec	0.375 (ns)
T13	Post-test	Vec vs. Ver	<0.001
		Ver vs. G	0.022
T22	Post-test	G vs. Ver	0.017
T24	Pretest	G vs. Ver	0.035
		Ver vs. MM	0.006
T26	Pretest	G vs. Ver	<0.001
		MM vs. Ver	0.013
T30	Post-test	BC vs. Vec	0.167 (ns)
		Ver vs. Vec	0.581 (ns)