Using Algebraic Reasoning to Model Gravitational Fields and Forces

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Author(s)	

Recommendation

Reject (contains basic errors and faulty judgements)

CONFIDENTIAL COMMENTS TO THE EDITOR(S)

The article does not offer aclear logic of the proposed research. There is no specific statement of the investigation. For example, is the primary goal of the research to study what would be a better approach to help students learn how to use the law of gravity? Or, is the primary goal to teach students the concept of a gravitational field? \r
It is not clear how the recitation of the general history of the study of gravity is related to the following parts of the paper. \r
The paper has statements which do not follow from evidence, but represent personal views of the author: for example: "the algebraic form of the law ... might hinder the effects of the gravitational fields". \r
Some statements are too general and automatically correct, for example: "I hypothesize that the phrase action-at-a-distance, if not explicitly explained by the teacher, might suggest ...". But in teaching physics, any phrase, or a statement, if not explicitly explained by the teacher might lead to numerous wrong interpretations, and the task of a teacher to give that explicit explanation. \r
When the formula is given to students, and "no more details are provided, the students might be in doubt how to use the formula". Again, this statement is automatically correct, because the teacher always has to do more than just presenting a formula, and if the teacher does not do it, students will be in doubt how to use the formula.\r
The description of the method demonstrates flaws of the research. For example, the text of problem 1, and the following student responses do not include any mentioning of "field". That is why it is not clear how "from the responses, one could infer that these students associate gravitational field with ...".\r
In discussion of answers to problem 1 the author writes "surprisingly, no student

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referred to the output of the product in the numerator of Newton's law". But the responses to problem 2 cleary show that only one student from the whole group knew the meaning of the law. There is no clear indication that students had "a week understanding of the underlying algebraic structure of the formula" - this statement would require factual proof that students had difficulty with that particular algebraic structure, which was not assessed in either of the pre-test problems.\r
The author does not show how the responses to problems 1 and 2 lead to the conclusions that mistakes "might be rooted in a lack of understanding the cause of force as action-at-a-distance".\r
The pre-test established that students did not know the Newton's law of gravity. Any other conclusions are no more than possible speculations.\r
The following lecture represents a version of a standard introduction of concept "gravitational field".\r
The post-test demonstrated some improvement in student understanding.\r
However, this only proves that when students did not know certain material, and teacher introduced that material, students learned the introduced material.\r
A possible study could have been based on two different versions of representing the new material, for example, one group of students would be presented with the concept of a field, and another group of students would be presented with the examples of direct application of the law of gravity (without using the concept of the field), with a following assessment (identical for both groups).\r
In fact, many practitioners successfully train students how to use the law of gravity without introducing concept of a "field". Comparison of different methods could potentially lead to a fruitful investigation.

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Files attached

Author's Response

Files attached