

Force and motion conceptual evaluation for teachers in secondary school



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Abstract

Teachers' knowledge, like students', must build on the previous knowledge they have. There is a close parallel between how change occurs in conceptions of science and how it occurs in conceptions of teaching. We are interested in to know what a physics teacher needs to know to be effective on teaching force and motion concepts. How students learn most effectively in Mechanics, is a subject for teacher skills. Thus the activities are designed and provide a didactic sequence to elicit and build on students' prior knowledge, to provide opportunities for them to test their initial ideas, and to guide them towards the development of ideas that are closely aligned with the ideas of scientists. "FORCE AND MOTION CONCEPTUAL EVALUATION" is a standard test that is used in this project. Most of the time FMCE is accepted to evaluate the student' conception in motion ,but it is obvious that the results will show the necessity of teacher training in this part and it can involve teachers with conceptual teaching and learning Mechanics and make them familiar with Physics research goals in this subject. The main goals in this project are following: 1) Self-evaluating for teachers to know their abilities and motivating them to be more active in teaching. 2) Recognizing the necessity and planning for teacher training projects.

Keywords: Physics Education, Teacher training, Secondary school, Evaluation, Force and Motion Concept.

Resumen

El conocimiento, al igual que los estudiantes los profesores, deben basarse en los conocimientos previos que tienen. Hay un estrecho paralelismo entre cómo ocurre el cambio en las concepciones de la ciencia y la forma en que se produce en las concepciones de la enseñanza. Estamos interesados en saber lo que un profesor de física necesita saber para ser eficaz en la enseñanza de la fuerza y los conceptos de movimiento. Cómo los estudiantes aprenden más efectivamente en Mecánica, es un tema de habilidades docentes. Así, las actividades están diseñadas y ofrecer una secuencia didáctica para obtener y aprovechar los conocimientos previos de los estudiantes, proporcionar oportunidades para poner a prueba sus ideas iniciales, y que los guíe hacia el desarrollo de ideas que están estrechamente alineados con las ideas de los científicos. "EVALUACIÓN DE LA FUERZA Y MOVIMIENTO CONCEPTUAL" es una prueba estándar que se utiliza en este proyecto. La mayoría de los FMCE momento de la aceptación para evaluar la concepción del estudiante en movimiento, pero es obvio que los resultados muestran la necesidad de formación del profesorado en esta parte y que puede implicar a los profesores de la enseñanza conceptual y la mecánica de aprendizaje y hacer que se familiaricen con la Física objetivos de la investigación en este tema. Los principales objetivos de este proyecto son los siguientes: 1) Auto-evaluación de los maestros para conocer sus capacidades y motivarlos a ser más activos en la enseñanza. 2) Reconocer la necesidad y la planificación de proyectos de formación del profesorado.

Palabras clave: Física Conceptual de Educación, Formación del profesorado, la escuela secundaria, la evaluación, la fuerza y movimiento.

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I. INTRODUCTION

Improvement of science education is an important need that has had considerable attention throughout the world. Efforts has supported activities in different countries to address the need for teacher upgrading and to introduce innovative learning approaches. In recent years, the focus in workshops for teacher trainers has been on the active

learning approach. This has included the development of teaching and learning materials like hands-on laboratory work, promoting conceptual learning and encouraging instructors to do research in physics education that incorporate this approach. The learner-centered pedagogical structure of the curriculum aligns well with standard tests for teacher professional development. We have improved a way to assess teacher understanding of the most basic

concepts in mechanics. The paper is addressed in introductory physics in high school level in Iran. FMCE provides information for evaluating and comparing the effectiveness of instruction at high school teachers and it helps instructors in teacher training courses see where their instruction can be improved. [1]ⁱ In this paper we want to evaluate teachers knowledge in introductory physics courses.

II. RESEARCH DESIGN AND INTERPRETATION

Teachers' knowledge, like students must build on the previous knowledge they have.

There is a close parallel between how change occurs in conceptions of science and how it occurs in conceptions of teaching. In a modern Physics class, students spend most of their time working in small groups, performing experiments, manipulating computer simulations, making sense of their observations, and then sharing ideas in whole class discussions. The instructor's role is to guide whole class discussions, to help set classroom norms that support the development of ideas based on evidence, and to promote participation by all students. We are interested in to know what a physics teacher in teacher training courses in Tehran Educational Organization needs to know to be effective on teaching force and motion concepts.

In this way, teachers become aware of the differences between the beliefs that they bring into the introductory physics classroom, and the actual physical laws that govern the physical world. We need a more detailed understanding of trainee learning in order to be able to design environments that effectively encourage appropriate thought and reflection. [2]

This study has demonstrated for teachers to improve conceptual understanding in Mechanics and try to improve knowledge, skills and competence to teachers. "Force and Motion Conceptual Evaluation" (FMCE) could be used as a standard test that shows the rate of teaching abilities. Research tools such as the FMCE are most effective to educators and researchers only when responses are examined to determined not only whether or not learners have the correct ideas but also what they do have (correct or otherwise) and how consistently they use these ideas across similar questions. [3] Most of the time FMCE is accepted to evaluate the learner's conception in force and motion ,but it is obvious that the results will show the necessity of teacher training in this part and it can involve teachers with conceptual teaching and learning Mechanics and make them familiar with Physics research goals in this subject. Most physics professors thought initially that FMCE are much too simple for teachers and expected that most would answer in a Newtonian way after traditional physics learning. [4] In this study, we will focus on five sets of questions from the FMCE that probe teachers' views of force and motion concepts.

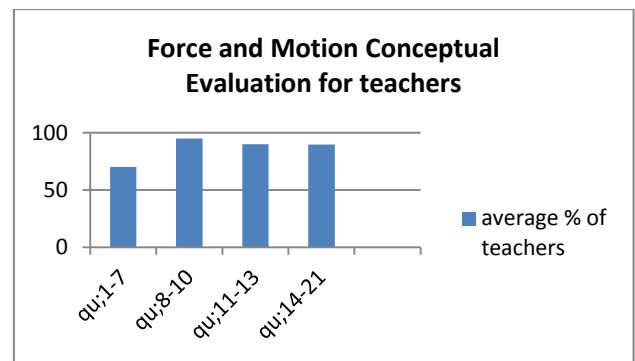


FIGURE 1. Teacher understanding of dynamics. Percent of a matched group of 20 general physics teachers who answered groups of dynamics questions in a Newtonian manner during traditional teaching to students in 2011. The Natural Language Evaluation is a composite of the force sled questions (1-7), and cart on ramp questions (8-10), the coin toss questions (11-13) and force graph questions (14-21) had to be answered correctly.

III. SUMMERY

All answers, "right or wrong" help us to evaluate teachers views about dynamics. We have developed the research-based Force and Motion Conceptual Evaluation for teachers understanding of mechanics concepts, and it is easily administered to large group of teachers in teacher training courses in Tehran Educational Organization. Our studies of conceptual understanding using this test show that physics teachers do not completely understand kinematics and dynamics concepts as a result of through traditional instruction. Since the choices available to teachers on the FMCE allow us to distinguish among common teachers views about dynamics, this test has been useful for guiding the development of instructional strategies for physics teachers. Assessments using the FMCE indicate that teacher understanding of dynamics concepts will be improved when some learning strategies are planned.

REFERENCES

- [1] Hestenes, D., Wells, M. A., *Mechanics Baseline Test*, The Physics Teacher **30**, 159-166(1992).
- [2] Redish, E. F., *Teaching Physics with the Physics Suit*, Chapter **10**, 182-201(2002).
- [3] Trevor, I., Smith, M., Wittmann, C., *Applying a resources framework to analysis of the Force and Motion Conceptual Evaluation*, Physical Review Special Topics, Physics Education Research **4**, 020101-0201012 (2008).
- [4] Ronald, K., Thornton, D., Sokoloff, R., *Assessing students learning of Newton's laws: The Force and Motion Conceptual Evaluating and the Evaluation of Active Learning Laboratory and Lecture Curricula*, American Association of Physics Teachers Am. J. Phys. **66**, 338-352 (1998).