EVALUATING THE EFFECTIVENESS OF A TUTORIAL INTERVENTION

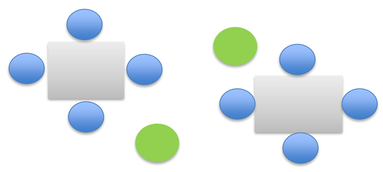
Students' learning of work-energy and impulse-momentum theorems

Mikko H. P. Kesonen // Risto Leinonen // Mervi A. Asikainen // Pekka E. Hirvonen
Department of Physics and Mathematics, P.O Box 111, FI-80101 JOENSUU, FINLAND

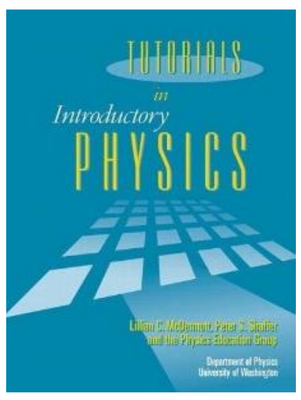
Introduction

What makes instructional innovations of physics transferable and effective in different educational contexts? To shed some light to this question, the alternative implementation of *Tutorials in Introductory Physics* -curriculum[1] is evaluated.

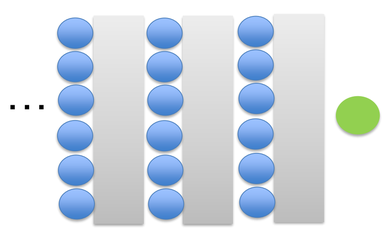
Tutorials…



are designed to be implemented in a small classroom setting.[1,2]



are shown to increase students' learning.[2]



can be used in a lecture hall setting.[1,4]

?

***Aim was to evaluate what extend the tutorials increase students' learning in a lecture hall setting*.**

Content & data collection

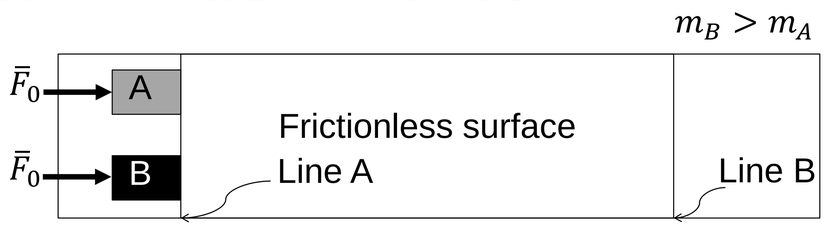
Students' learning was evaluated at the topics of the energy-work and impulse-momentum theorems.

The evaluation was carried out during a 90-minute *tutorial intervention* (TI) that was held in a introductory mechanics course. A total of 77 students participated in the intervention and 69 gave a permission to use their answers for research purposes.

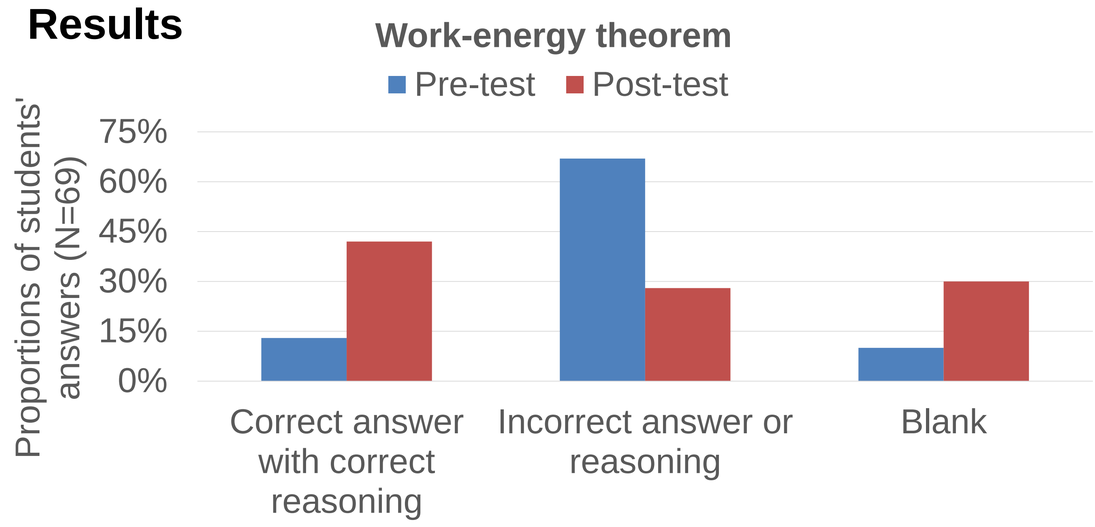
The structure of TI

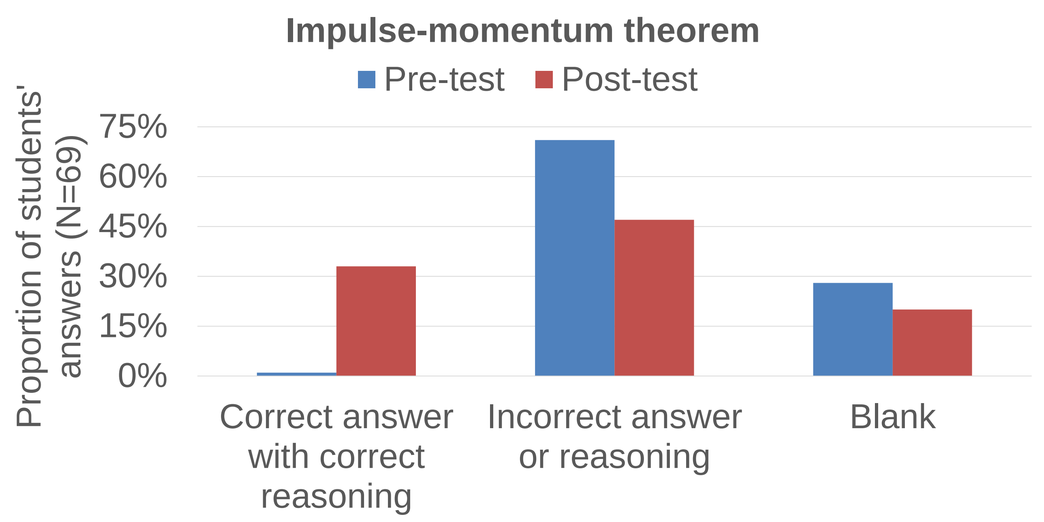
Pre-test (10 min) → Working with the *Changes in Energy and Momentum* worksheet *(p. 55-59 in Ref 1)* → Post-test (10 min)

The tests were based on the study of O'Brien Pride *et al.* (1998)[3]. The test questions were as follows: *Compare the final kinetic energies and moments of blocks A and B, as they travel from rest at line A to line B.*



Results





Discussion

- TI helped students to develop their abilities to apply work-energy and impulse-momentum theorems.
- Improvements in the proportions of correct answers are comparable to those obtained from the small classroom implementation of the tutorial[3].
- The effectiveness of the tutorial curriculum seems to rely more on its content than its implementation format, as previously suggested by Kryjevskaia *et al*. (2014)[4].
- Thus, the content of the tutorial curriculum seems to make it a transferable instructional innovation.
- The contents of the tutorials are based on extensive research that determines the objectives of the instruction, which may be the key for transferable instructional innovations.

References
[1]McDermott L. C., Shaffer P. S. & the Physics Education Group at the University of Washington (2010). *Tutorials in Introductory Physics*, New Jersey: Prentice Hall.
[2]McDermott L. C. (2001). Oersted Medal Lecture 2001: "Physics Education Research—The Key to Student Learning". *Am. J. Phys.*, *69*, 1127-1137.
[3]O'Brien Pride, T., Vokos, S., & McDermott, L. C. (1998). The challenge of matching learning assessments to teaching goals: An example from the work-energy and impulse-momentum theorems. *Am. J. Phys*., *66*, 147-157.
[4]Kryjevskaia, M., Boudreaux, A., & Dustin, H. (2014). Assessing the flexibility of research-based instructional strategies: Implementing tutorials in introductory physics in the lecture environment. *Am. J. Phys., 82*, 238-250.

CONTACT INFORMATION
mikko.kesonen@uef.fi

UNIVERSITY OF EASTERN FINLAND