ENHANCING PERFORMANCE IN THE "FORCE CONCEPT INVENTORY" TEST USING HOMEWORK GAMEPLAY WHILE INVOLVING PHYSICS TEACHERS IN THE LEVEL DESIGN PROCESS: SPACEFART.

Patrice Potvin
Martin Riopel
Julien Mercier
Patrick Charland
Alexandre Ayotte
François Boucher-Genesse

Université du Québec à Montréal

EXTENDED ABSTRACT

CONTEXT / It is now very well recognized that students have difficulties learning physics because of the existence of initial non-scientific naïve conceptions that interfere with learning (Duit & Treagust, 2003). Many tools have been developed to enable teachers and researchers to diagnose these conceptions in specific domains and to make students modify them toward more scientific mental models or schemas (DiSessa, 2006). Among these tools, a very well known and many times validated test, the "force concept inventory" (FCI), has been developed to assess conceptual development of the concept of force (Hestenes, Wells, & Swackhammer, 1992). Computer games have also been proposed, among others, as interesting tools for science education. In the last few years, we have developed an –amusing- simulation game, called "SpaceFart" (SF), that addresses conceptual and intuitive understanding of basic mechanics (kinematics and dynamics). SF is an online flash application where a creature (a "spacewhale") must travel through mazes with possibly moving walls, gravity, and other types of constraints. The trajectory of the "spacewhale" has to be "pre-programmed" through a "flight plan" that constrains reflection, forces explicit prediction, links intuitive/qualitative understanding with mathematical formulations through simple counting operations. The level design process can be carried by educators, granting them an active role in the pedagogical use of the application. Designed sequences can also be proposed as homework for students that can be carried out at home and automatically emailed? to the teacher when done. RESEARCH QUESTION / "Can the use of an interactive simulation like SpaceFart produce better conceptual understanding than the use of ordinary homework?" METHODOLOGY / Two physics teachers were trained during in-service training on the SF

application. These teachers had the duty to produce two content-equivalent homework treatments composed of four short assignments that aimed at enhancing conceptual understanding regarding the concept of force. One of these treatments was of a classical form of homework (paper-and-pencil) and the other used SF. In this second treatment, teachers had to develop complete sequences of levels. 112 "secondary five" (12^{th} grade) physics students from two schools were pretested using 17 questions of the FCI test. All of them had then finished their mechanics lesson and were in the situation of preparing revision for the standardised test, two months later. These students had to do homework sequences in order to carry out this revision. About half of them (randomly selected) were subjected to treatment 1 (with SF) and the other half participated to treatment 0 (ordinary homework). The students were immediately post-tested with the same 17 questions, and then retested again a month later to measure retention. Other socio-contextual questions were also asked to control the equivalence of the groups and for further research. ANALYSIS AND RESULTS / Results have yet to be analysed and discussed. We intend to give a first look at these results at the "Meaningful play 2010 conference".

KEYWORDS / game, conceptual change, physics, homework, teachers

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