Applying Serious Games to Motor Learning in Sport

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ABSTRACT

Considering the wide use of Serious Games in application fields like cognitive learning, health education and rehabilitation and the recent developments of sensor and interface technology it is surprising that applications to motor learning in sport are rare. The aim of this study is to examine whether a specific learning effect can be elicited by training with a commercial exergame (Nintendo Wii Sports Resort). A sample of 23 young club basketball players attended either a virtual training (VT) or a real training (RT) of basketball throws. Training consisted of 750 throws distributed to 10 training units. As a result, VT and RT groups improved in virtual and real performance, but only the RT group transferred training to the virtual condition. Furthermore, the RT group enjoyed training more than the VT group. As a conclusion, added values of Serious Games in sport skill learning may take effect only under certain conditions.

Keywords: Basketball Training, Exergames, Game Experience, Game-Based Motor Learning, Perceptual-Motor Transfer, Sport Skills, Throwing

INTRODUCTION

The application of digital games to serious purposes like learning and training promises numerous new options. The surplus values of these ‘Serious Games’ have been extensively discussed (Ritterfeld, Cody, & Vorderer, 2009), e.g., enhanced motivation (Felicia, 2012), interaction, immediate feedback, activation of learners, integration of knowledge and application. Whereas Serious Games have been extensively applied to enhance cognitive learning (for reviews, see Mitchell & Savill-Smith, 2004; Hays, 2005; Egenfeldt-Nielsen, 2006; Vogel et al., 2006; Kebritchi & Hirumi, 2008), health and physical fitness (for reviews, see Baranowski et al., 2008, 2010; Wiemeyer, 2010) and rehabilitation (e.g., Wiemeyer & Kliem, 2012), applications in motor learning are rarely to be found (for reviews, see Kretschmann, 2008; Papastergiou, 2009). Rather the possible detrimental effects of video games for physical activity and health have been addressed (e.g., Griffiths, 2005). This situation somehow mirrors the state of the art in multimedia learning. In multimedia learning studies focusing motor learning are also very rare (e.g., Vernadakis et al., 2006a, 2006b, 2008). The development of new game controllers (e.g., contact mat, mo-
tion sensors, force platform, and 3D camera) caused a fundamental change: movements of the whole body or big parts of the body can now be used to control the game. This gives rise to new options for physical activity and motor learning. Therefore, the main purpose of this paper is to test whether the application of a video game using motion sensors is able to enhance training and motivation concerning motor skills in sport.

In the following text, existing studies on motor learning are analyzed in order to derive an expectation concerning possible mechanisms of Serious Games to enhance motor learning. In the second part, an experimental study will be presented designed to test effects of virtual vs. real training on learning a basketball skill.

**REVIEW OF THE LITERATURE**

In this section, existing studies dealing with learning and training of whole body movements will be reviewed. Of course, there is also evidence that video games improve elementary perceptual and motor skills, e.g., spatial perception (Green & Bavelier, 2010) and endoscopic surgery (Lynch et al., 2010). Studies improving physical fitness (e.g., endurance and strength) are also neglected because they are more focused on energy as compared to information processing. For the present paper gross motor skills in sport are most relevant.

Fery and Ponserre (2001) performed a two-factor experiment comparing different types of instruction and attentional focus using a video game teaching the putting movement. The players had to move the mouse to the left or the right in order to control the putting movement of a video model (backswing and downswing). Two groups (‘analogue’) attended to the amplitude and timing of movements of the putting model (avatar), while two other groups (‘symbolic’) focused on a gauge signifying the amplitude and timing of the putting movement. A second experimental factor was instruction. Half of the subjects of each group were either instructed to establish a maximum progress of the virtual player (‘enjoyment’ groups) while the other participants were told to learn for transfer to actual putting (‘learning’ groups). After a pre-test, all participants of the four experimental groups attended 10 training sessions including 20 virtual trials playing the video game. After the training period which included a total of 200 trials a post-test was performed. The pre- and post-tests included 10 real putting trials. An additional fifth group (‘control’) only performed a pre- and post-test. The results showed no differences concerning the Constant Error. Both symbolic groups outperformed the control group concerning the Absolute and Variable Error. Furthermore the symbolic-learning group performed significantly better than the symbolic-enjoyment group in the post-test (Absolute Error). Overall, the study confirms a significant superiority of exercising the (virtual) putting by focusing on a symbolic representation of amplitude and timing as compared to an analogue representation.

Secondly, the study confirms the significance of the intention to learn for transfer of virtual gaming experience. The study did not address issues of game experience (e.g., fun, motivation, immersion). Therefore, it is not clear whether the participants used the game just as a simulation tool or really experiences the sensation of gaming.

Hebbel-Seeger (2008) applied a sailing game to the education of sailing novices. The sailing game included two locations: the sailing area and the teaching room. In the sailing area the players could choose between sailing course, free sailing, and competition. In the teaching room the players had four options: instructional videos, knots, wind and sailing courses and model of the boat. The mission of the game is to get a sailing license by completing all the tasks within the game. Hebbel-Seeger examined a game group which consisted of students who had to learn to operate a sailing boat and a no-treatment control group. After the completion of the sailing game the learning group had to perform a real sailing test whereas the control group performed the test without any
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