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DEVELOPMENT OF INQUIRY SKILLS THROUGH GAME-TRANSFORMED INQUIRY-BASED LEARNING IN BIOLOGY FOR EIGHTH GRADERS

Summary of the PhD dissertation

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The aim of this research is to develop a game-transformed inquiry-based development program that can be used to improve inquiry skills of 8th grade students in biology. In the theoretical background of the research the dissertation discusses the concept of inquiry skills and scientific thinking, concepts related to scientific inquiry, inquiry-based learning, games for educational purposes, and teachers' beliefs about technology and pedagogical content knowledge of games. This research includes five sub studies: (1) the examination of the Hungarian teachers' beliefs about digital game-based learning, (2) piloting of the student demo; (3) a database and website testing; (4) the experimental trial of the BioScientist development program; (5) and the extended trial of the BioScientist development program. To examine the teachers' (N=102) beliefs about digital game-based learning, the Game-based Learning Teaching Belief Scale instrument was adapted to Hungarian, and a few new background variables were added to the original questionnaire. The responses of the questionnaire help to develop the BioScientist program and to learn about the beliefs of the Hungarian teachers. As part of this research, the BioScientist digital program was developed. Completing the stations of the BioScientist program was partly a home task and partly a classroom task, which was complemented by class discussion. The class discussion was facilitated by the teachers. The program development was aided by two smaller studies with students: the piloting of the student demo (N=34) and a database and website testing (N=20). Subsequently, the impact assessment of the program was aided by two steps: the experimental trial ($N_{experimental}$=83, $N_{control}$=122) and the extended trial ($N_{experimental}$=132, $N_{control}$=125). The students' inquiry skills were measured with the Inquiry Skill Test, and their biology learning motivation was measured with the Biology Learning Motivation Questionnaire. The most important results of the research are that the inquiry skills of 8th grade students did develop due to the six-week intervention with the BioScientist program in both the experimental trial and the extended trial, though the effect size appeared to be small ($d_{experimental\ trial}$=0,29; $d_{extended\ trial}$=0,27). The students' biology learning motivation did not change significantly due to the development program. Based on feedback from the teachers, the program proved to be suitable for classroom application. The teacher's guide, the own BioScientist account, and the teacher's mode of the website provided enough help for teachers to effectively use the program in everyday practice. Based on the student feedback, the BioScientist program is suitable for students to study at home on their own. According to the students, the tasks of the program helped them understand the curriculum and the scientific process, the latter being an important objective of teaching science. This research draws attention to the huge pedagogical potential of technology-supported hybrid inquiry-based approaches and the value of researching them. The importance of the research is that it supports with data the international trend that the inquiry skills of primary school students can be improved through game-transformed inquiry-based learning.