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Digital Dichotomous Key in Botanical Education of Pupils in Primary School[2]

Extended summary

Many studies have concluded that students have little knowledge about plants and do not understand their importance in nature. The low level of students' knowledge about plants results in *plant blindness*, characterized by the following facts: students believe that plants are just a habitat for animals; students do not understand the process of circulating matter; they do not recognize the importance of plants in everyday life; they cannot recognize the basic plant species in their surroundings; they do not understand the growth and propagation of plants. The introduction of modern teaching methods into biological education could reduce the phenomenon and effects of plant blindness in students. The aim of this research was to determine the contribution of using the created digital dichotomous key (DDK) and instructive (traditional) method (IM) to the quality and durability of the eighth-grade students' knowledge of the *Systematics and Plant Classification*. It also aims to examine the students' opinion on the contribution of the DDK to

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their knowledge and motivation for learning botanical content. The research involved 120 eighth-grade students (12-13 years old), who were divided into two groups (E – experimental group and K – control group) that were equal in a: number of students, their achievement in the first school term and their pre-test achievements. The contents of the *Systematics and Plant Classification* were taught in both groups within nine teaching hours. The students in group E used the DDK for teaching content, while the same teaching content in the group K was processed in the traditional way. The DDK used in the research was created by the authors of the research according to the principles of constructivist teaching. The achievements of students in the *Systematics and Plant Classification* were measured using a post-test and re-tests which contained questions at all cognitive levels (knowledge, understanding, application, analysis, evaluation and synthesis). Dependent variables in the research are: the quality and durability of students' knowledge in the *Systematics and Plant Classification* at each cognitive level and the students' opinion on the impact of DDK on the quality of their knowledge and the motivation for the study of plants. Independent variables are the application of DDK and IM. Students' opinions were examined by using a survey. The survey had 18 subjects containing three blocks of questions. The first block of questions examined the way in which students had learned the biological content in the previous grades. In the second block, students expressed their opinions on the contribution of DDK to the quality of their knowledge on the *Systematics and Plant Classification*. In the third block of questions, the students gave their opinion on how the contents and activities in the DDK were presented, and whether DDK influenced the students to identify the plants faster, to make their determination interesting and motivating for learning. The questions in the survey were open, close and combined. Similarities and differences between the knowledge of the E and K groups of students on the pre-test, post-test, and retest at each cognitive level were determined by the nonparametric Mann-Whitney test and an independent t-test. Kolmogorov-Smirnov's normality test determined whether the post-test and retest data had a normal distribution. The reliability of the survey was determined by the factor analysis of the main components with rotational impediments, Bartlett's spherical significance test and Kaiser-Meyer-Olkin test (KMO). The values of Kolmogorov-Smirnov normality test show that the post-test and retest data have no normal distribution ($p < 0.05$). On the post test, the E group members scored 1624 points more than the K-group students, while on the post-test they scored 1213 points more. Students in the E group were more successful than students in the K group in solving tasks at higher cognitive levels: analysis, evaluation and synthesis. The results of the research point to the fact that DDK contributes more to the quality and durability of students' knowledge, compared to traditional (instructive) teaching. The survey results showed that students from the E group have a positive opinion on the application of the DDK. For most pupils, the display of plants, pictures, illustrations, and texts in the DDK are clearly interesting and attractive, and the activities are very motivating. The majoeity of the E group students think that DDK motivated them to learn more and explore plants from their surroundings. Within the subject *Biology* in primary school, the priority should be given to the DDK in relation to traditional (instructive) teaching, since it contributes more to the acquisition of students' knowledge at higher cognitive levels and develops a positive learner's opinion on learning.

Keywords: botanical knowledge, digital dichotomous keys, instructional method, primary school students.

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