

ABSTRACT

Students' understanding of experiments in an introductory physics laboratory course at Birzeit University

The study aimed to study students' understanding of physics experiments in an introductory physics laboratory course at Birzeit University, and to examine the effect of experiments' characteristics, gender, and collective experience on that understanding. The research also investigated the relationship between achievement (both in the course and general) and understanding.

Students' understanding was examined using four experiments with two varying characteristics: procedure (short and long) and device (simple and complicated). Each of the 38 students comprising the sample was interviewed using a four-part questionnaire: the first part examined the students' understanding of the aim of the experiments, the second examined the students' recognition of the devices of the experiments, the third examined the students' understanding of the role of devices of the experiments, and the fourth examined the students' understanding of the procedure of the experiments. The validity of the questionnaire was judged by ten experts in the field of physics, while the reliability of the four forms were found to range from 0.73 to 0.90 using the test-retest method.

The students' understanding of experiments was qualitatively described, while the effects of the characteristics of the experiments were tested through using two analysis of variance with repeated measures. T-test was used to test the effect of gender and collective experience. Pearson correlation coefficients were calculated to describe the relations between the students' understanding, and final and cumulative scores.

It was found that the average level of students' understanding in the four experiments was medium, ranging from very good to fail. The average level of students' understanding of the aims of the four experiments was very good, ranging from excellent to fail. The students' average level of recognizing the devices of the four experiments was very good, ranging from excellent to good. The average level of students' understanding the role of the devices in the four experiments was medium, ranging from excellent to fail. The average level of students' understanding of the procedure in the four tasks was acceptable, ranging from very good to fail.

The effects of the procedure length and the interaction of procedure length and complexity of devices on students' understanding were found to be significant at the 0.05 level, while the effect of complexity of devices was found not significant at the same level. No effect was found of gender and collective experience on students' understanding at the level $\alpha=0.05$.

The correlations between students' understanding and their final and cumulative scores were found to be 0.48 and 0.47 respectively.

The main conclusions of this study were introducing a theoretical and procedural frame of testing the students' understanding of the experiments effectively, examining the effect of the experiments' characteristics on that understanding, and identifying the students' misconceptions. The recommendations of this study were in three fields: future studies, assessment of hands-on experience, and teaching methods of laboratory.