

The improvement of independent learning through the use of a virtual laboratory in chemistry hybrid learning

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ABSTRACT: Information and Communication Technology (ICT) can support the implementation of a virtual laboratory in chemistry hybrid learning (ViCH-Lab). The use of a ViCH-Lab on the topic of the hydrolysis of salt was studied, by which the improvement of the students' independent learning was measured and compared to that of students who did not use it. The virtual laboratory was developed in HTML format with animations. The ViCH-Lab mainly contained menus of learning materials, laboratory work topics, and evaluation. The method of research was a mixed method with embedded experimental design. The total number of samples were 68 students from class XI, consisting of 34 students in an experiment group and 34 students in a control group. The students in the experiment group learned chemistry through both regularly scheduled face-to-face sessions and teacher supervised online practices through the ViCH-Lab on a website, while those in the control group were only taught through regularly scheduled face-to-face sessions without the online component. The data regarding the improvement in the students' independence was collected at the beginning and at the end of the learning activities using a questionnaire, and during the process of learning using an observation checklist. The data was analyzed statistically by an independent sample t-test and descriptive analysis. The results showed that the improvement in students' independence in the experiment group was significantly higher than that of the control group.

1 INTRODUCTION

A teacher plays an important role in education. Beside teaching, they are also educators (Yuswono et al, 2014). They are required to create creative and innovative learning processes, facilitating students to be as active as the curriculum requires. Many learning processes were dominantly controlled by teachers in one-directional learning or teacher-centered learning. The observation of learning processes in some schools in Yogyakarta, Indonesia showed that some learning activities were still done through teacher-centered learning. Teacher-centered learning was closely related to the culture of Indonesia. Indonesian teachers, whose youngsters usually tend to follow older people's directions, should ensure that students are challenged and active in the learning process. According to Nugroho (2012), students should be active in learning activities, while teachers should be active in preparing learning packs, motivating students, and making the learning process more effective.

Chemistry learning materials are wide-ranging and comprehensive, consisting of macroscopic and microscopic concepts, which challenge students to find an appropriate learning strategy. Since chemistry is learned as a separate subject for the first time at senior high school level, many students find chemistry to be a difficult lesson as it contains intangible concepts. In fact, the concept must be built and constructed by students. For that reason, learning chemistry requires visualization. This visualization can be achieved through working in the chemistry laboratory. In the laboratory, students will be shown the phenomena of a chemical concept through the experiments that are conducted by the students themselves, from which they are expected to be able to build the concept on their own. One of the topics in chemistry that needs practice in the laboratory is salt hydrolysis. The topic is scheduled in