Mobile Technologies in Blended Learning of Engineering Students in Digital Measurements on Geodetic Equipment

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Specialists in the architectural and construction industry should have the skills in using geodetic equipment.

Students need to understand the sequence of correct production actions, pay attention to typical errors, avoid hard-to-repair failures for equipment.
Surveying instruments provide the possibility of a variety of measurements and readings: elevations between points, horizontal and vertical angles, line lengths, and many other measurements.

Sometimes the process of verifying the correctness of taking data by a student requires the lecturer to re-focus the visual tube under himself that significantly increases the time taken to control the students’ work.
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The creation and using simulator tools with imitation of real measurements are useful for students' additional individual learning and control of independent training.

They are effective for solving didactic problems in blended learning and complements the on-site work of students with laboratory equipment.
Online laboratories do not replace but rather complement traditional on-site laboratories. Online laboratories – remote and virtual – can be considered as web-service platforms flexibly combined with the use of social networks in higher education. Virtual laboratories involve using virtual tools with computer simulation of equipment.

Virtual work with equipment using multimedia (or VR, AR) has a wide list of pedagogical opportunities and can be successfully used as an element of distant technologies in traditional, blended and online learning in engineering universities.
Hybrid laboratories provide both physical and online forms of operation with the same equipment or devices of the same functionality. Mixed combinations of physical and online components form different types of hybrid laboratories.

The variant of hybrid laboratories with a virtual component and a variable (stationary and mobile) physical component is important when training for using geodetic equipment.

This is useful to develop a hybrid laboratory that consist of physical - both stationary on-site and portable (mobile) components supplemented by an online component in the form of virtual learning tools with imitation of the work of geodetic equipment.

The virtual component may be a set of virtual learning tools (such as interactive multimedia educational resources) specially designed for the didactic tasks of teaching work on laboratory equipment.
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Site http://geo-s.sibstrin.ru of the head of the students’ creative workshop “Geo-S” Olga Solnyshkova (Novosibirsk State University of Architecture and Civil Engineering (SIBSTRIN))
Erroneous recording: there is no counting sign in the vertical circle

Erroneous recording: minutes have recorded to the nearest whole numeric
Right sights and errors in taking data on a leveling rod
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The use of virtual simulators and other online tools is especially effective when students familiarize with the learning content using the “flipped class” method and then train in a hybrid laboratory.

Students can use virtual learning tools to update knowledge and skills at a convenient time and place using personal mobile devices. They place a mobile device with a virtual learning tool next to stationary equipment in order to repeat simulated actions or to self-control during laboratory work on engineer geodesy.
During geodetic practice professional business game is conducted with the imitation of the geodetic service of a construction enterprise.

Survey (78 students, in total) showed that 93.6% (73 students) used the developed virtual tools while performing practical tasks with equipment on the terrain.
Results of experimental work in Novosibirsk State University of Architecture and Civil Engineering (SIBSTRIN)

The last current annual survey of students was carried out remotely using social networks, it covered 94 students of NSUACE (Sibstrin) who studied engineering geodesy during the year.

When answering the question “What device are you viewing the site from?”, only one student answered that he (she) did not use the site, the rest ones indicated the following methods (several answers were allowed): smartphone 78.7% (74 students), laptop 59.6% (56 students), stationary computer 20.2% (19 students), tablet 9.6% (9 students).
CONCLUSION

Applying personal mobile devices is a convenient solution in the initial training of engineering students on geodetic equipment since most of the geodetic instruments are portable. The configuration of hybrid learning environment based on interactive virtual learning tools and mobile devices is offered for training of inexperienced students to make digital measurements on geodetic equipment.

The hybrid environment includes a hybrid laboratory of geodetic equipment consisting of a physical (both stationary on-site and portable) component supplemented by an online component of interactive virtual learning tools simulated the work of geodetic equipment and the possibility of user’s self-assessment.

Virtual simulators and other e-learning tools may be accumulated on the site with online support for the course of engineering geodesy and supplemented by means of distant communication of lecturer and students.

Virtual tools for digital measurements imitation can be used together with “flipped class” method for initial training at work in a stationary laboratory, for updating knowledge and skills through interactive self-monitoring, supporting the fulfillment of professionally authentic activities – conducting a professional business game or individual practical tasks on the terrain with portable geodetic equipment.
Thank you for attention!

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