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USAGE OF INTERACTIVE TOOLS FOR ORGANIZING DISTANCE CLASSES

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Abstract

The purpose of the article is to study the effectiveness of using interactive learning tools in organizing classes in Programming in a distance format. Methods/Analysis: Various interactive tools are now widely used to organize elements of face-to-face learning, mainly for supporting student independent work. However, the use of these tools in a distance format, as well as the study of the possibility of expanding and modifying the forms of classes in these conditions, is quite an urgent issue to observe. Training with these tools takes place in three stages: preparatory, procedure and control. The application of such tools is based on the principle of individualized learning, when each student learns within his schedule, receives personal advice from a teacher, and has personal educational space. The authors organized the training in three subjects: Programming Technologies, Human-Machine interaction and Algorithms and Data structures to test the effectiveness of the study. Sholom- Aleichem Priamursky State University was the experimental facilities of the study. Findings: It was found out that using interactive learning tools in conducting classes allows one to increase the effectiveness of Programming subjects in a distance format. The results show that the improvement was 30 per cent in the experimental group, while the improvement was only 17 per cent in the control group. Applications / Improvements: Further research may be connected to the use of such systems to increase a variety of learning tools, as well as designing challenges to support these tools.

1. Introduction

In present-day education, there are many tools to provide learning support. Systems are often used to organize the learning environment to control a student educational trajectory (Verdú et al., 2012). The number of automated environments has also increased significantly (Step.space…, 2020), which allow one to check up the tasks without involving a teacher (Alkaria, 2017). In addition, there is a significant increase in the use of mobile devices to enable learning anywhere with an Internet connection (Jones & Jo, 2004). To ensure the student involvement in the learning process, when using these tools, it is necessary to take into account such parameters as interactivity, the ability of the system to respond to human actions (Combéfis et al., 2016). On the other hand, the sanitary and epidemiological situation in the world has forced the use of these tools as a distance learning form with no chance of face-to-face review sessions. This, among other things, has caused a large number of developments in the field of indirect communication and communication in the network and involving these systems, including in learning activities.

In this study, this refers to the special peculiarities of distance teaching SAPSU students to the subjects devoted to Programming and the study of the effectiveness of this training in comparison with a similar process taking place in a classroom mode.

2. Problem Statement

In the current epidemiological situation, universities were forced to shift to distance learning, which caused several difficulties. The difficulties related both to the problems of finding the best means for organizing online classes in subjects, and reviewing the teaching aids and tasks for organizing this form of training. The inability to give lectures and personal tuition in a person-to-person format set a difficult task for teachers to provide information to students. In these circumstances, educators decided to gather a variety of tools that allowed one to organize communication with the groups of students quickly, complete practical tasks and test students' skills.

The review reveals that there is an invariant set of educational tools for any training (Liu et al., 2020; Piteira et al., 2018; Smyk et al., 2020; Watanobe et al., 2020). Their use has a fairly long history, so there is already a stable set of course components. It should be noted that in this case, it refers to digital means and tools, however, analogue tools are quite amenable to digitization. In general, this list includes:

* Lectures: a text with possible hypertext, video with timestamps, audio recording.

* A set of test tasks: intermediate tests, tests for passing control points, final tests.

* Practical tasks in a wide variety depending on the subject taught and the approach.

Besides, when designing the learning process, most courses require a user's profile; a place where data is collected about his achievements and the work that he needs to perform. One also needs a place to centralize all the components described above to obtain an externally unified logically interconnected structure. This list served as a foundation for further preparation for the courses.

3. Research Questions

The educators choose a social network as a means of a centre for interaction with students. Most social networks currently have a large number of functions for organizing group activities, such as Conversation, Community, etc. Besides, they can pin or download multimedia files, that is, there is a possibility of storing teaching aids within one resource. Within this study, instructors arranged a community to coordinate and support a group of students in three subjects, so the community became a centre of interaction between a teacher of these subjects and students (Figure 01).
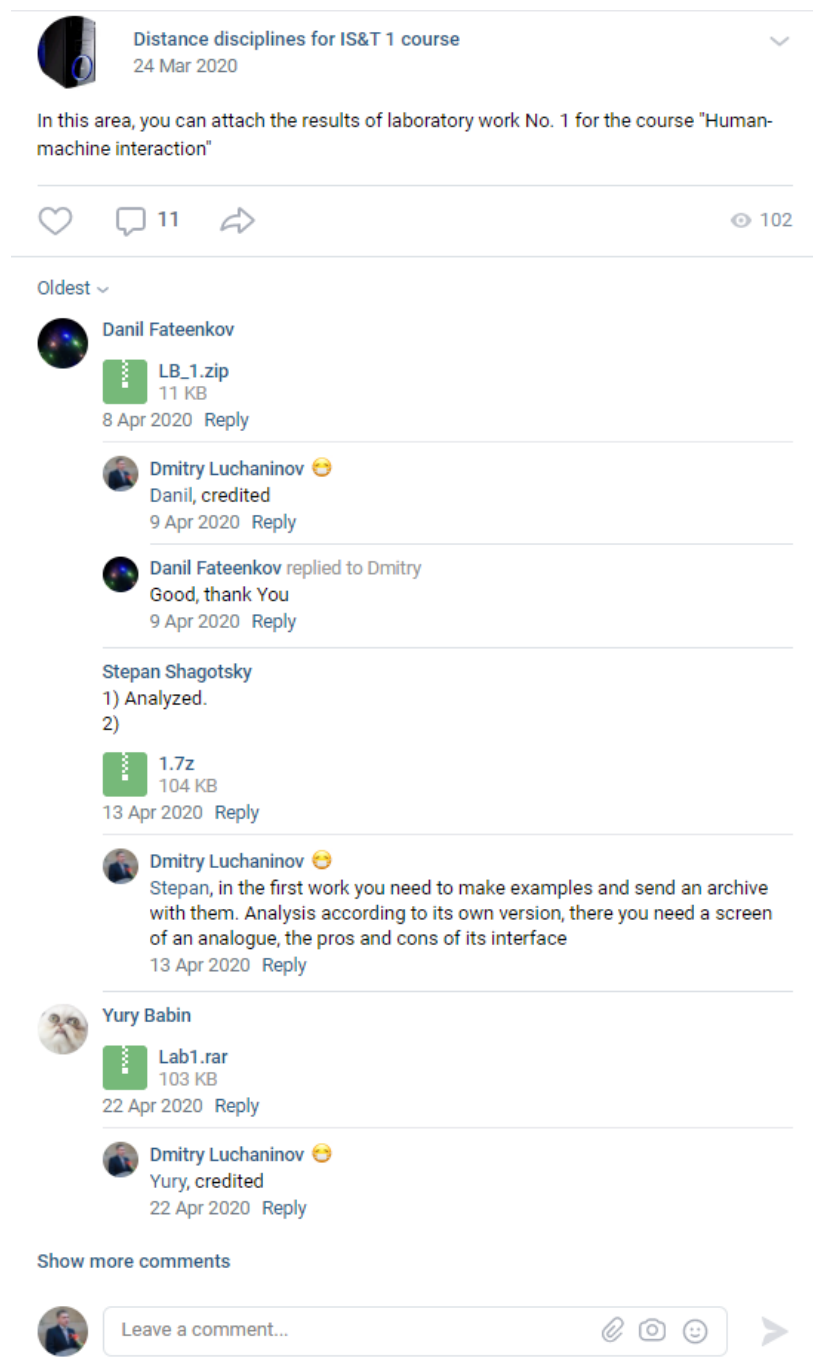

Figure 1. Organization of study in the social media VKontakte

Through social networking sites, in addition to the YouTube video hosting system, broadcasts and record storage were organized for students who, for one reason or another, were unable to attend the classes. Two types of tools are usually used for this: pre-recorded video and broadcasts (streams). In the first case, it is reasonable to use recording programs, for example, OBS Studio, where it is possible to set various elements for output, such as a web camera, their order and visual effects. Also, Zoom and Skype systems were used for personal tuition and testing (Figure 02).

Stack
This course element is graded like 'Lab'
value: 1.0
till 28 mar. 2020. 11:00 HST
⊞ Add this page to my bookmarks

Stack

0.0/1.0 point (graded)

Input filename:	input.txt
Output filename:	output.txt
Time limit:	2 seconds
Memory limit:	64 megabytes

Make the stack work. For each operation to remove an element, print its result.

The input to the program is lines containing commands. Each line contains one command. The command is either "+ N", either "-". Command "+ N" means adding a number to the stack N, modulo not exceeding 10^9. Command "-" means popping an element from the stack. It is guaranteed that not an empty stack is popped. It is guaranteed that the size of the stack during the execution of commands will not exceed 10^6 elements.

Format of an input file
The first line of the input file contains M ($1 \leq M \leq 10^6$) — the number of commands. Each subsequent line of the source file contains exactly one command.

Format of an output file
Print the numbers that are removed from the stack using the command "-", one on each line. The numbers must be printed in the order in which they were popped from the stack. It is guaranteed that no pops are made from the empty stack.

Test

input.txt	output.txt
6	10
+ 1	1234
+ 10	
-	
+ 2	
+ 1234	
-	
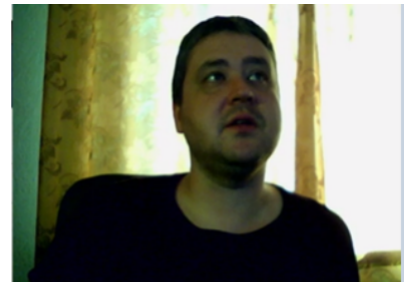
Figure 2. Broadcasting in the social media community through OBS Studio

In many ways, learning Programming is connected with mastering a large number of examples related to the use of certain algorithms and algorithmic constructions. Within this approach, it is reasonable to use an automated system to check the solutions to the problems. Each task according to the standard used, for example, in the Olympic movement system ICPC, consists of several points (Fig. 03).

- the problem condition, which describes the legend, is a significant and consistent as possible, giving complete information about what needs to be programmed;
- data types used in the solution and, accordingly, in the verification of the problem;
- test cases to be checked by a student before direct uploading the problem solution to the system.

Figure 3. Task in the system Steach.space

During the study, students receive points for completed tasks. If the task is completed incorrectly, the system issues an explanatory error, for example, that the program has exceeded the time or memory limit. During the entire training period, the teacher works as a tutor (Woods, 2020) through social media, helping students in difficult situations on subject issues.

4. Purpose of the Study

The purpose of the article is to review and observe the effectiveness of using interactive learning tools in organizing classes in Programming subjects in a distance format.

5. Research Methods

The authors arranged training in three subjects: Programming Technologies, Human-Machine Interaction and Algorithms and Data Structures to test the effectiveness of using interactive learning tools in Programming-related subjects in the 2019-2020 academic year. Sholom- Aleichem Priamursky State University was the experimental field of the study. As an experiment, a group of the first-year students majored in Information systems and technologies was selected. The experiment involved 14 students in the experimental group and 18 students in the control group. The control group was trained in the fall of 2019

in person-to-person training supplied with interactive learning tools. The experimental group was trained in the conditions of distance learning using the social media VKontakte as information and communication centre and automated task control systems. For the experiment, a community was arranged, where teaching aids were presented according to the following plan: the systems with automated task verification were set up for two subjects; the content was put directly in the community members for one subject. Besides, there was a link to the point-rating system, where students could monitor the points they were awarded for the subjects studied (Figure 04).
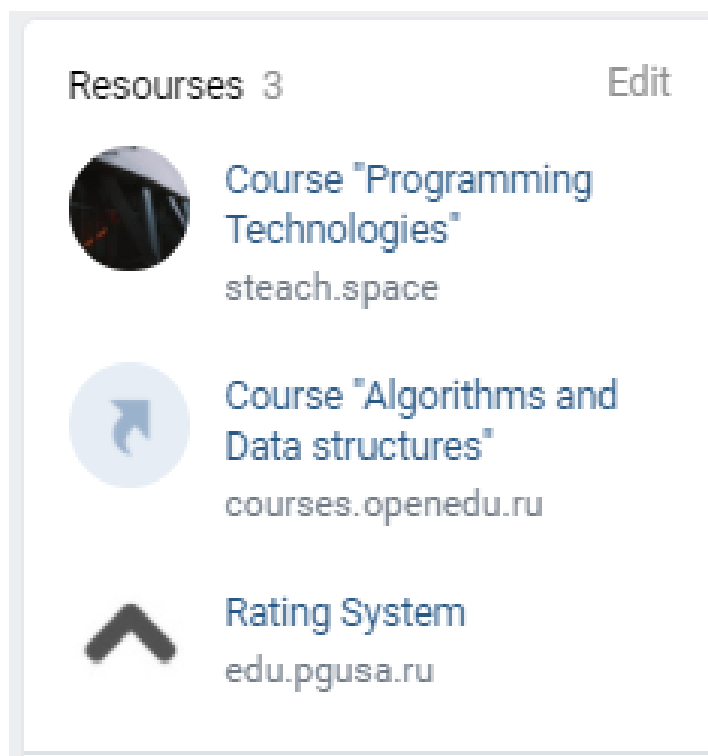
Figure 4. Links to the subjects in the VKontakte social media community

Teaching using interactive tools to test their effectiveness took place in three stages: preparatory, procedure and control.

At the preparatory stage, entry testing was conducted for each group of students. The teacher made up the tests based on the following content to assess the existing competence proficiency. Then, the teacher taught students how to use interactive tools with which they would deal with. For the control group, these tools were presented as classroom software, automated task verification systems. It was noted that they had an opportunity to use them outside the classroom to solve problems. For the experimental group, in addition to these tools, certain tools for communication guided by the teacher, organizing group work online with a teacher's support, and the regulations for operating in a social media were presented.

At the procedural stage, the learning process was carried out. The peculiarities of it are mentioned above.

At the control stage, a final assessment was made. It allowed educators to quantify changes in the learning process. Technically, both the entry and final testing were carried out in Moodle. The questions for both groups were the same.

6.   Findings

When evaluating students' successes, a teacher used a hundred-point system. According to the assessment, all the students were divided into three groups according to their proficiency level: low (less than 33 points), medium (34-66 points), and high (more than 67 points) according to the test results. Since the study involved three subjects at once, the average value of the three test results was used as the scores for each student. The results of the study are presented in Figure 05.
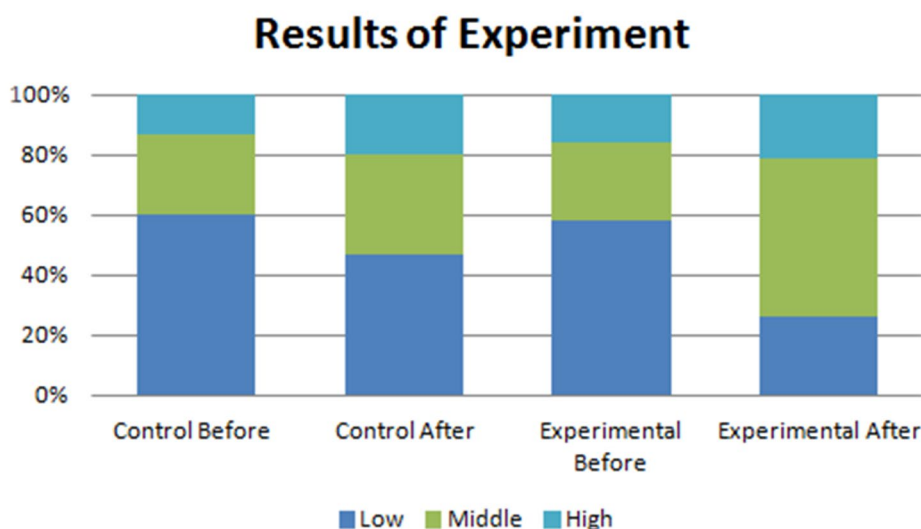
Figure 5.   Results of the study in the control group

The results show that in the experimental group, the improvement was 32 per cent, vs only 20 per cent of the improvement in the control group. Besides, a significant decrease in the number of students in the low group should be noted, which stands for a positive motivational aspect in this approach to online learning.

7.   Conclusion

Using the interactive learning tools in Programming subjects proves its effectiveness, especially in situations where the direct learning process is limited or impossible. Automated task verification systems allow one to maintain the intensive learning process. So the use of a tutor-based learning support approach allows one to avoid most problems with student motivation. It should be emphasized that using these tools allows for more effective teaching of low-level students, keeping high-level students on a progressive trajectory of vocational development. Further research can be related to the use of such systems to increase a variety of teaching tools, as well as designing task modules to support these tools. Finally, the development of interactive tools used can be referred to as intensification and automation of students' textual and visual projects.

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