DATA MINING IN EDUCATION: ONLINE TESTING IN LATVIAN SCHOOLS

Loreta Juškaite
Riga Technical University (RTU), Latvia
E-mail: Loreta.Juskaite@rtu.lv

Abstract

The new research results on the online- testing method in the Latvian education system for a learning process assessment are presented. Data mining is a very important field in education because it helps to analyse the data gathered in various researches and to implement the changes in the education system according to the learning methods of students.
The aim of the research was to analyze how much time students devote to each task depending on the task type and the cognitive activity level in the online national test.
Research methods: 1) analysis of scientific literature; 2) descriptive statistics and dependency analysis for processing the data.
Research results showed that the time spent on tasks depends not on the complexity of the task but on the form and formulation of it.
Keywords: *online test, data mining, cognitive actitity level*.

Introduction

Nowadays, with the growing attention to educational data mining, it is important to use the possibilities provided by technologies - like data gathering and data analysis in a new level to use the results in order to improve the learning process. The aim of Diagnostic tests is to find out students' basic skills acquisition on finishing a certain level of education according to the national education standards and the subject curriculum requirements. For the last three years, schools in Latvia have the choice of how to take Diagnostic tests, either in online or paper form. The choice is made by the school itself, in accordance with its capacities and needs. Diagnostic online and paper tests take place simultaneously (VISC, 2015). For two consecutive study years (2015/2016 and 2016/2017), research has been carried out whether it is possible to carry over Diagnostic tests from one environment into another one, by maintaining the same content, task functions, and other testing elements. On Diagnostic test results at the basic school level, the study was performed in Natural Sciences and at the secondary school level in Physics and Chemistry (Jonane, &Dzerve, 2016, Cabelis, 2015; Juskaite, 2019). The study indicated that there was no statistically significant difference between the obtained data. (Juskaite, 2018). The issue is to understand whether the unanswered question means the lack of student's knowledge or inability to comprehend the gist of the question. For example, students are used to study in the traditional way (from books and papers), and later they are required to take their tests online, or vice versa, studies that have been carried out by using a tablet or a computer are requested to take a test in paper format. In both cases, the student experiences are in a completely contrasting

situation (Juskaite, 2018). For instance, a piece of paper can be turned over, but online testing means looking to the screen and using the scrollbar. Obviously, it is rather complicated to answer the question when one has to switch between the extracts or refer to a passage having been exposed to earlier. The questions are identical to the ones on paper format, but the presentation of it is sufficiently different. The relevance of the question of whether it is essential to practice within the environment that the test is being carried out is recently increasing. The benefit of saving paper and other resources has been highlighted so far, but students remain at the centre of the focus. The individual growth, development of new skills and competencies, purposeful guidance of a learner towards modern society and lifestyle should be considered equally important (uzdevumi.lv, 2017). Online learning has a rapid entrance in training environments, therefore, it is essential to characterise the changes brought along. During the analysis of students' behaviour, it was possible to identify risks and to seek solutions. It allows to trace trends and plan development much more effectively (Attali & Tamar, 2000; Huberman, Bitter, Anthony, & O'Day, 2014; Kehoe, 1995; Sočan, 2009). Although many tasks or problems in the educational environment have been managed or resolved through the knowledge of the way how students solve exercises of various type, it is important to continue the research on student behaviour in the online environment (Deshpande, 2017; Daugule & Kapenieks, 2019). The content of the tasks was developed by the National Centre for Education, and the online environment was provided by uzdevumi.lv.

Research Methodology

This is the first attempt in the Latvian education system where the research of student time investment is considered in each type of tasks depending on levels of cognition and task types. The main aim of the research was to analyse how much time it is necessary for the students to complete each task depending on levels of cognition and task types. For this research data mining technique has been used. The analysis of the research data was carried out using Classical Test Theory (CTT) and Test Analysis Program ITEMAN™ for Windows. The figures and tables were created using MS Excel and Tableau Public 10.4.2. A student completed 30 tasks online. The tasks had different levels of difficulty and response types (multiple choice, fill in the missing word, explain the choice in written form). The 22 tasks of the test were evaluated automatically by the computer programme. The tasks where students had to enter a word (1, 13, 14, 23, 27 and 28) were partly evaluated by the system. If a student wrote one of the words matching those entered in the system, a point was granted; otherwise – all the imprecise answers were tested by a teacher, whose estimate on the applicability of the answer is important since a student might have made a spelling mistake in the response. Eight tasks of the test (5, 6, 7, 18, 19, 25, 29 and 30) were evaluated by a teacher online. When the evaluation of all student performances is completed, a teacher must click the "Checked" button at the bottom of the results page, and all the results are transferred to the National Centre for Education within an hour (VISC, 2018).

Research Results

During the 6th-grade diagnostic test in the last academic year (2017/2018), a time controlling mechanism was built in to indicate the time required for students to complete each of the tasks. The sequence of response types was also mixed; no multiple-choice answers were provided, but the students had to read and comprehend the gist of the provided answer. It is very difficult to perform this test if it is presented in a more traditional (paper format) way. The created system fixed and recorded the time spent on each task by every individual student. Since the test included tasks of various types and diverse levels of cognitive activity, the obtained data helped analysing the time used to complete each of the specified tasks and significantly affected the decision making. Since online and paper-based tests take place simultaneously, it is possible to analyse students' behaviour and other abilities as common changes in educational processes in Latvia. Diagnostic tests were chosen as a sample in order to ensure that changes will not affect the exam performance (VISC, 2017). This research analysed the achievements of students based on their skills, cognitive level and spent time. The results were obtained after compiling and processing the data. The average task performance in the country was about 64.91%. It demanded more time for students to complete the tasks with longer formulations of the exercises. Particularly long time was necessary for students to solve tasks that contained elements of research. Tasks that provided graphical information and icons were done quickly and accurately by students. The diagram (Figure 1) shows that these results are appropriate and require less time to perform the task.
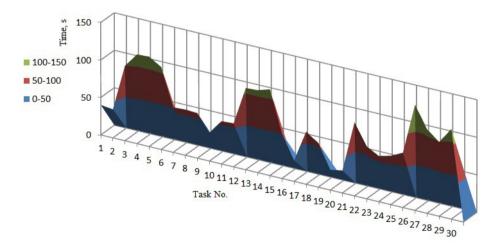

Figure 1. Time for each task (average).

The time spent on tasks depends not on the complexity of the task but on the form and formulation of it. Almost 20% of the students could not fulfil all the tasks in the required time, 14% of the students completed only 18 tasks with multiple choice but did not answer to the other questions even though they had enough time for it. If we compare the results with cognitive activity levels, we can clearly see that the longest tasks were dealt with first and third cognitive activity levels, while the lowest time cost was in the

second cognitive activity level, despite the fact that there was a lot of text in the wording of the tasks. The time spent on tasks depends not on the complexity of the task but on the form and formulation of it. Almost 20% of the students could not fulfil all the tasks in the required time, 14% of the students completed only 18 tasks with multiple choices but did not answer to the other questions even though they had enough time for it.

Conclusions

The number of participants in total was large enough ($N = 5794$) to draw objective conclusions about students' knowledge and skills.
The tasks with a lot of text in the wording demanded more student time. The particularly long time was necessary for students to solve tasks that contained elements of research. Tasks that provided graphical information and icons were done quickly and accurately by students.

In conclusion, the time spent on tasks depends not on the complexity of the task but on the form and formulation of it.

During this academic year, the research is continued by observing other aspects and analysing new situations. As a future intention is to enrich it by encompassing more user behaviour cognitive functions, which will allow getting the results on how exactly learners react to each type of tasks.

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