

Statistical Process Control Education using Distance Learning

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Abstract: The paper describes the experience and system of work when applying the most demanding subject in Moodle. The course *Statistical Methods of Quality Control* is intended for students of the daily form studying by the distance method. Topics like SPC, seven base tools of quality management, and others master students using sophisticated tools of computer support. These are, for example, a webinar or remote access to the PALSTAT CAQ information system server.

Keywords: SPC - Statistical Process Control, LMS – Learning Management System, webinar.

JEL Classification: I23, I24

1 Introduction

This Innovative teachers can not imagine a teaching process without modern didactic tools. But some teachers are fighting new things and are opposed to using them. I belong to the first group and try to use modern didactic tools in every subject I teach.

2 Information about the course

The course MQ 501S Statistical Methods of Quality Control (the SMQC) thematically covers the topics of Quality Management: Seven basic tools of quality control (7 QC Tools), SPC - Statistical Process Control and others. The seven QC tools include:

1. Cause-and-effect diagram (Ishikawa or fishbone chart);
2. Check sheet (also checklist);
3. Control charts (is also related with SPC);
4. Histogram;
5. Pareto chart;
6. Scatter diagram;
7. Flow chart.

SPC is method of measuring and controlling quality by monitoring the manufacturing process.

Objective of the course in terms of learning outcomes and competences The aim of the subject is to acquire knowledge and skills for using statistical methods in full respect of quality standards requirements in accordance with quality management systems and TQM. TQM practices can be broadly classified as either “mechanistic” or “organic” where former is the systematic measurement and work controls to reduce variability [5].

After completing the course students will be able to effectively use methods SQC, SPC, emphasis will be placed on mastering the use of the methodology related modules IS PALSTAT CAQ in accordance with ISO 9001, ISO / TS 16949 and the requirements of the automotive industry IATF, AIAG, VDA.

The course content draws mainly from the literature: NENADÁL, J. et al. 2008. *Moderní manažment jakosti : Princípy, postupy, metody*. Praha : Management Press, HRNČIAROVÁ, L., TEREK, M. 2004. *Štatistické riadenie kvality*. Bratislava : IURA Edition and ISO 7870-2:2013. *Control charts - Part 2: Shewhart control charts*. The Fig. 1 is part of the syllabus of the course *Statistical Methods of Quality Control*.

TÝŽDEŇ	TÉMA A ZADANIA
1 3.4.–9.4.	Úvod do problematiky; Štatistické metódy a systémy manažérstva kvality; <i>Úvodné zadanie (SLA); online aktivita 1. (fórum)</i>
2 10.4.–16.4.	Jednoduché štatistické metódy v manažerstve kvality - 7 základných japonských nástrojov QC (7 QC Tools); <i>Zadanie č. 1</i>
3 17.4.–23.4.	Štatistické riadenie kvality - SQC; <i>Zadanie č. 2 (formou fóra)</i> Termín pre vybavenie proktoringu a zaslanie informácie o proktorovi a mieste záverečnej skúšky vyučujúcemu (do 23. 4. 2017)
4 24.4.–30.4.	Štatistická regulácia procesu - SPC; <i>Zadanie č. 3</i> <i>Zadanie projektu v PALSTAT CAQ (modul SPC)</i>
5 1.5.–7.5.	Regulačné diagramy pri kontrole meraním; <i>Zadanie č. 4 (formou fóra)</i>
6 8.5.–14.5.	Regulačné diagramy pri kontrole porovnávaním;
7 15.5.–21.5.	Ďalšie typy regulačných diagramov; <i>Zadanie č. 5</i>
8 22.5.–28.5.	Spôsobilosť procesov, zariadení a meradiel, MSA;
9 29.5.–4.6.	Štatistické preberanie; <i>online aktivita 2. (fórum)</i>
10 5.6. – 11.6.	Záverečná skúška v Trenčíne - Pia 9. 6. 2017, v Bratislave - Po 12. 6. 2017 <i>Odvzdávanie projektu na UPLOADER (13. 6. 2017)</i>

Fig. 1 Syllabus of the course *Statistical Methods of Quality Control*

The target group of the e-course is represented by students of Quality Management - Specialization in Business Management Studies. Students are studying this course daily by using distance method. Distance learning - learning without being in regular face-to-face contact with a teacher in the classroom [1]. The evaluate of students is based on the assignments (Tab. 1).

Tab. 1 Evaluation of course *Statistical Methods of Quality Control*

Assignments	Percentage of Final Grade
Participation (practical assignments and online activity)	40 %
SPC project	30 %
Final Examination (open book PC test in Moodle)	30 %
TOTAL	100 %

Computer aided of this course include MS EXCEL, MINITAB®17, PALSTAT CAQ®, use MS SQL server and RDC (*Remote Desktop Connection*).

3 Organization of learning activities

The course MQ 501s is taught by a distance method and has standard e-course support in the open source LMS in platform Moodle. In Fig. 2 is the entrance to the education environment of the VŠM in Trenčín.

Fig. 2 LMS Entry Gate and distribution of e-courses to categories

In the VŠM is created a working position "Online Center Administrator" to manage e-courses. All of the e-courses for all subjects of the VŠM are regularly updated, after the end of the quarter, they are backed up and stored in the archive. There is a certain amount of time available to the teacher. Subsequently, e-courses go to "Šrotoviska", where they will be erased after a certain time. Subjects for the next trimester are recovered from the backup in the "Preparation". This system provides the maintenance, reusability and sustainability of the online education system of the VŠM, which is very robust (it contains on average 150 different e-courses per trimester).

The E-course is divided into 10 blocks, each for one quarter a week. In this e-course, the scope of the subject matter prescribed in the syllabus of the subject is completely covered. This is especially because it requires electronic support for students of the distance method. Educational goals (learning objectives) are summarized in syllables, divided and then inserted into individual learning blocks in the sense of Bloom Taxonomy [1].

Each topic has a tutorial in various forms. In the practical part, most of the examples are processed in MS Excel, which contain a clear commentary and formulas for a better understanding of the solution's results. In the Fig. 3 is the introduction to the e-course MQ 502s.

Fig. 3 Introduction to MQ 502s Statistical Methods of Quality Control

The calendar alerts students to different dates of activities (assignments, forum submissions, tests, etc.) and greatly helps organize the study, which is especially important when using the distance method. Regular contact of the teacher with students studying distance is provided by the Webinar. The webinar is available every week for one to two hours. Students can communicate with a teacher as a classical consultation but online. They can also share their files and present problem and other colleagues in the team.

A great help for students of both methods is the recordings of past webinars, placed in the "Online Support" block. In the Fig. 4 is the webinar in *Blackboard Collaborate* (BC) platform.

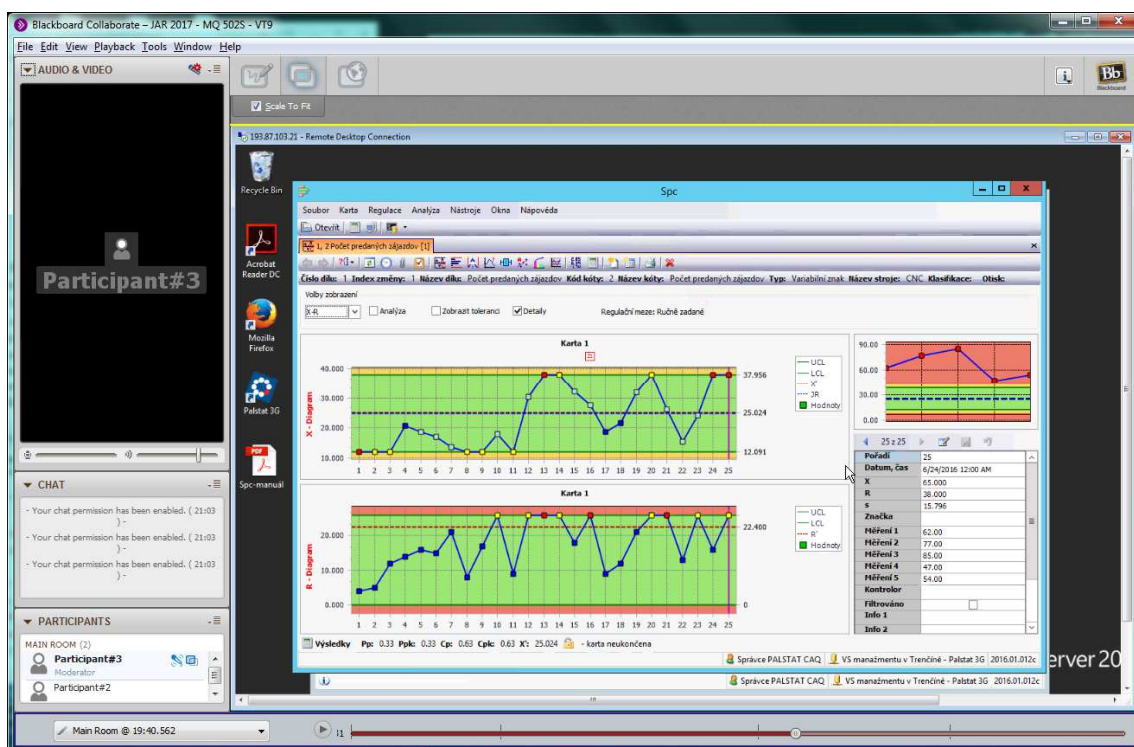


Fig. 4 The webinar in Blackboard Collaborate

4 Course processing

The structure of the e-course is in line with the standardized "template" of the VŠM. The minimum content structure of which must be complied with by all teachers (so far only in the distance study). There is a minimum number of media sources (custom videos, online support files, audios, video clips, hyperlinks, etc.). Educational goals (learning objectives) are summarized in syllables, divided and then inserted into individual learning blocks in the sense of Bloom Taxonomy.

Each topic has a tutorial in various forms. In the practical part, most of the examples from the obligatory literature are processed in MS Excel, which contain a clear commentary and formulas for better understanding.

5 Activation of students

The E-course combines elements of synchronous and asynchronous communication. Synchronous is ensured by the possibility of gradual visualization of prepared content in accordance with time schedule and style, deadlines for fulfilling different tasks and the term of regular webinars (online consultation) for the distribution of students.

Students use several well-known e-learning tools to share electronic materials (lectures, examples, case studies, assignment tasks), electronic tests with random selection of different types of questions (including self-assessment tests), surveys, teamwork. Distance students use, in addition to these tools, constructive discussions in forums and webinars, which are an interface between the classroom and the e-course (students meet with teachers at the same time

from different places). Continuous assessment managed by the online system's direct feed-back possibly increased the efficiency of the continuous assessment further [6].

Some tools share both "day" and "online" students, even collaborating on some activities and enriching each other. In e-course is a balanced number of activities in which students work in a team (for example, structured forums) and activities that are focused on the implementation of individual skills (practical assignment in MS Excel, etc.). In the Fig. 5 is the illustration of structure of e-course MQ 502s.

29 máj - 4 jún

9. TÝŽDEŇ - UČEBNÝ CIEL: Oboznámit' sa s princípmi štatistického preberania

ZREALIZUJTE tieto činnosti:

1. Pozorne si preštudujte **kapitolu 14.5** z materiálu v prednáškach (Nenadál, 2008)
2. Dokončíte a odošlite **5. ZADANIE**
3. Využite možnosť **otestovať** si svoje vedomosti z **1. až 9. týždňa v SAMOHODNOTIACOM teste**
4. **PROJEKT SPC**: zrealizujte projekt v PALSTAT CAQ a popíšte ho v **požadovanej dokumentácii**
5. **Hlasujte v ankete**, **kde a kedy pridete** osobne na záverečnú skúšku

Prednáška

📖 Štatistická prebierka ..., kap. 14.5 (NENADÁL, 2008)

Aktivity

🗳️ ANKETA: Miesto a termín záverečnej skúšky

Online podpora

🗣️ 9. WEBINÁR - UTOROK, 30.5.2017 od 18:45-19:45

🗣️ VIDEONÁHRÁVKA - 9.WEBINÁR - otázky k importu dát do PALSTAT CAQ a iné...

📺 VIDEO: Prebierka vo výrobnjej praxi (ukážka)

Test

📝 OTESTUJTE SA (1. - 9. týždeň)

5 jún - 11 jún

10. TÝŽDEŇ - UČEBNÝ CIEL: Záverečná evaluácia vedomostí a zručností

ZREALIZUJTE tieto činnosti:

Fig. 5 Structure of e-course MQ 502s

6 Conclusions

The aim of improving the quality of higher education is to bring the forms of study closer to the content. Based on my own experience, I know it's possible ...

But only:

- with motivated teachers,
- with technically competent teachers using electronic tools appropriate to a particular subject,
- on the LMS platform maintained (LMS Administrator Function),
- but especially with the necessary institutional support of top management.

Literature

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