

Classroom Management and Feedback Systems

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This article devoted to discuss the contemporary techniques of students' educational work activation during lectures. The necessity for a lecturer to apply CRS (classroom response systems) is substantiated. Consider some of the technical aspects of CRS, possible models of using of CRS in the lectures are discussed—traditional and activating the educational work of students. Three groups of didactic functions of CRS—motivation, activating, and management are assigned. On the basis of this classification and didactic functions of CRS, teachers can build various options, lectures, including those that enhance the learning activities of students. Such experience is available from the authors of this article. Highlight issues requiring decisions in connection with the use of CRS in the educational process.

Keywords: teacher feedback, CRS (classroom response systems), management training, modern lecture, clicker

Introduction

A “tool paradigm” refers to the usage of a new invention and assimilation of that invention in human lives, such as the telephone, the personal computer, and every other innovative invention that changed our lives. The term uses to articulate today's status in education, whereas ICTs (information and communication technologies) recently revolutionized in its field, as they compel teachers to adapt to the new environment:

- (1) Will the new ideas regarding what is needed to be studied change?
- (2) How effective is the new technology in students' learning experience?
- (3) How students see the effectiveness of the new technologies?
- (4) How can we estimate the effectiveness of the new technologies?
- (5) How should we run the course and the direct connection with students?

Proper use of ICTs in education can help achieve two major educational goals: individualization of education and enhanced training of students. The importance of these tasks has long been declared, however, real opportunities to address them in the traditional educational process (without the use of ICTs) were absent. According to Starichenko (1998), this is due to teachers' difficulty in organizing exchanges of information among many students, in view of the volume and speed of communications needed for active learning activities (pp. 106-110). Contemporary uses of ICTs in higher education institutions, including universities' digital libraries, distance learning, websites of academic disciplines, computer control systems, and so on, offer students effective access to diverse sources of information and allow students to develop an individualized learning path. Availability and access to such emerging resources is also a condition for enhancing training,

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improving cognitive independence, and a shift of emphasis to individual students' work.

Another condition for intensification of educational activity is feedback between students and teachers, which corresponds to general theory of systems control. In the works of Bospalko (2002), Itelson (1964), Mashbitz (1987), and Starichenko (1998), which dealt with informational aspects of educational process—the great didactic importance of feedback between students and teachers is stressed. It is on the basis of information obtained through feedback channel that a teacher can manage the course of obtaining and adoption of educational information.

The theory of feedback in educational process is rooted in the works of Thorndike written in 1911. It touches upon the issues of feedback model construction in educational process, effective means and methods of its realization, timing of feedback, and feedback learning outcomes (Mory, 2003). In the control theory for a general case, the requirements for information obtained through feedback channels are defined: completeness, adequacy, and immediacy. It is very difficult (or even impossible) to provide this requirements at the lecture without using a teacher of technical means. It is connected with the limited information bandwidth teacher, and as a consequence, impossibility to properly manage the progress of the learning process, which involves simultaneously many students.

Main problems can be solved if the teacher use CRS (classroom response systems). Many papers on various aspects of CRS have been published (Crouch & Mazur, 2001; Fies & Marshall, 2006; Martyn, 2007; Lasry, 2008; Mayer, 2008). However, the above-mentioned works mostly are dedicated to technological and organizational aspects of the use of CRSs or describe the authors' (private) experience of the application of the CRSs. The questions connected with pedagogical and methodical peculiarities of CRS use are described in the literature much weaker. The discussion of some didactic aspects related to the use of CRS in lectures is the subject of this article

Formulation of Research Problem

According to Crouch and Mazur (2001) and Fies and Marshall (2006), proper organization of educational resources and the use of modern means of communication not only improve information delivery and management of educational process in traditional university forms of educational process, but also create a fundamentally new form of education involving remote lectures, seminars, forums, consultations, self-testing, and the use of Wiki-resources (Fies & Marshall, 2006). The use of these resources significantly change the content and organization of practical classroom courses (laboratory work, seminars, practice sessions, and tests), and especially, self-learning activities. Management of educational work of the students under any form of training is carried out on the basis of inspection results.

In educational practice, methods of control are well developed and widely used. The inspection results are useful to evaluate the quality of teaching. It should be noted that the control, and accordingly, the adoption of decisions on the management of the learning process are suspended characters (performed in "off-line" mode): The inspection is conducted in the course of the training session, and the verification and analysis of its results in extracurricular time. Apparently, this situation can be considered acceptable during training of a practical nature. However, management of the learning process should be carried out by the teacher during the lectures too.

We can identify two main features of the lecture form of training sessions complicating the organization of feedback:

(1) A significant number of students (50-200 persons), with whom communication should be supported simultaneously;

(2) The connection must be made directly during presentation materials (in the “on-line” mode).

Feedback from the audience allows the teacher to identify and assess mastery of the material in the audience during the presentation, and if necessary, adjust the presentation. Usually, a lecturer sets the connection through questions addressed to the audience: “Is it clear?”, “Are there any questions?”, and so on, but the verbal poll of the audience, at which the participants should give answers publicly, as a rule, does not reflect the true understanding and mastery of the material, due to the psychological characteristics of an individual’s conduct in the large group.

In this regard, it seems to be important to explore the use of technical means in lectures conducting, which could provide operational feedback to the teacher with a large audience in real time. Problem involves many aspects of technology (What technical means are needed?), substantial (What are the peculiarities of representation and presentation of the material?), organizational (How to organize the work of the listeners?), and analytical (What should be the content of information in the feedback circuit and what conclusions can the teacher make in the course of lectures on the basis of this information?)—Obviously, this list can be continued. Any of the above aspects of the problem can be adopted as the primary and by them will be determined by decision of the remaining aspects. In our research, as a primary was adopted the technology of CRS, based on ICTs. Such systems are quite actively used in educational institutions in the USA, however, experience in universities of Russia and Israel are much more modest. This work, performed in the Ural State Pedagogical University (Yekaterinburg, Russia) and Ariel University of Samaria (Ariel, Israel), is a development of joint research on various aspects of application of information technologies in educational process at universities (Yavich, Starichenko, Makhrova, & Davidovich, 2007; Starichenko, Egorov, Davidovich, & Yavich, 2010; Egorov, Davidovitch, & Yavich, 2012; Starichenko, Egorov, & Yavich, 2013). In particular, it considers the didactic possibilities of CRS and discusses the conditions for their efficient use.

Technical Aspects of CRS

Electronic surveys, introduced in the mid-20th century, were the forerunners of classroom-based feedback systems. Electronic surveys were bulky, wired systems, and used mainly for ongoing or final test control. In the 1970s-1980s, many universities had such systems in place, although, their use was not associated with the task of enhancing students’ learning.

With the introduction of PCs (personal computers) into higher education, electronic survey systems were replaced by computerized control systems, which provide teachers with greater pedagogical options relating to developing tasks, and automating surveys and evaluations. Computer control systems continue to perform successfully, but they are not suitable for use in lectures with large audiences.

The first wireless device suitable for large classrooms, remotely connected to a PC, appeared in the US in the 1990s. These devices were called “response systems” (or “distant response systems”) and were designed to process and present survey results to teachers or participants almost instantaneously. These systems were originally used primarily in various polls and were first implemented in education field in the late 1990s.

Since then, devices that poll and present survey results in real time have not changed fundamentally: Systems comprise personal wireless devices, a signal receiver, and hardware and software installed on a PC. In recent years, the entire system is installed in a notebook, which also offers portability.

Wireless remote control is a device with one or more keys, which participants use to respond to the survey and send a signal to a receiver connected to a computer. In English literature, such devices were unofficially coined “clickers”. Recently, clickers were supplemented with an independent memory that not only sends the responses to the signal receiver in the form of alphanumeric expressions, but also stores them in memory for later use.

Reception and transmission use infrared or radio frequency communication. Systems based on infrared communication require a line of sight between the transmitter and the receiver, and these systems also have problems registering a large number of simultaneous signals from the transmitters. Therefore, in our view, they are ill-suited for large lecture halls. In terms of quality, systems based on radio communications should offer two-way transfers. The receiver is typically connected to a computer using a USB (universal serial bus) port.

The software package usually contains tools for designing surveys and classroom management tools. Software integrates with Microsoft PowerPoint, which allows teachers to design, aggregate, and display survey results in the form of interactive presentations in real time.

The described array includes a laptop, a receiver, and 30-50 remote devices, and it is very compact and can be easily deployed in all types of audiences, and does not require significant technological teacher training.

Didactic Models and Functions of CRS

Based on previous studies and our own experience, we distinguish two models of application of CRS when conducting lectures.

In the first model (traditional), the survey system is considered as a superstructure over the traditional lecture. The teacher is the central active figure in the classroom, while the students play the role of passive listeners, and the teacher occasionally involve the students in some activities. Surveys during the lecture take the form of questions pertaining to the factual parts of the material presented or formal evaluations of the students' level of assimilation (such as “Is everything clear?” and “Should I repeat the material?”).

The second model (activating), known as “peer instruction”, represents a much-needed paradigm shift to active learning in the classroom. In this case, the students are the central active figures, while the teacher develops the materials, manages the students' discussions, and guides the students in the necessary direction. Discussions are took place in pairs (student-student) or groups, and are typically limited in time. Questions are presented twice: after the first presentation, each student answers individually; the question is presented once again after the debate. A good question can be considered as the question which causes even distribution of answers in the first round of voting, but it has a concrete answer, which students must find in the process of discussion.

Apparently, it is possible to combine the models of the application of CRS—Choice should be determined by the didactic expediency and objectives of the lecture, which are set by the teacher. In all cases, CRS performs the same technological function—It provides rapid feedback between students and teachers.

The listed models using CRS can be associated with its pedagogical functions. The following classification is based on the authors' experience with CRS at the Ural State Pedagogical Universite in Russia and Ariel University of Samaria in Israel, and on existing literature. We distinguish between three groups of functions of CRS: motivation, activation, and management. The first two groups relate to students' activities in the classroom, while management pertains to teachers' activities.

(1) Motivational functions include:

- (a) Audit attendance;
 - (b) Provide an interactive and engaging classroom experience;
 - (c) Anonymous survey;
 - (d) Check students' understanding and assimilation of new materials.
- (2) Activating functions include:
- (a) Ensure participation;
 - (b) Enhance learning;
 - (c) Develop analytical thinking;
 - (d) Develop skills of scientific discussion.
- (3) Management functions include:
- (a) Provide rapid feedbacks from audience, regardless of its size;
 - (b) Simultaneous collection of survey results from all students;
 - (c) Instantaneous processing and output survey results in a convenient form for subsequent analysis;
 - (d) Opportunity to view and analyze individuals' responses and detect clusters of patterns;
 - (e) Accumulate, store, and subsequently processing individual and group results of the survey.

In the development of the latter, it should be noted that due to the CRS, it is possible accumulation, storage, and subsequent processing to facilitate the development of extensive databases on the ongoing work of each student in each class. The use of automated statistical methods allows teachers to review and examine the progress and predict the results of the learning process for students in groups and individual students. Thus, CRS give teachers a wide range of opportunities associated with the organization of lectures and management process transfer-receipt and uptake of educational information.

Conclusions

On the basis of the above-mentioned classification of didactic functions of CRS, teachers can build various options, lectures can enhance the learning activities of students. Such experience is available from the authors of this article. However, the drafting of such lectures creates the need to address a diverse range of issues:

- (1) Based on the results of voting (the distribution of responses identified by CRS), how teachers diagnose the pedagogical situation in the audience and choose the optimal management action?
- (2) How to include a variety of continuation of the lecture, depending on the distribution of votes in the answers to check question?
- (3) What type of and how many questions for the audience should be considered as pedagogically justified?
- (4) How to estimate the lecture activities of the students and how it may affect the final evaluation of study of academic subject?
- (5) How to make a statistical analysis of the current results and build a forecast at the end of the training?

Our research is focused on the solution of the listed problems. Through solution, these issues can be expected the fundamental change of the methodology of lectures, as they are adapted to the requirements of modern education. This determines the relevance of our study.

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