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EXPERIENCE IN THE USE OF CLASSROOM FEEDBACK SYSTEMS IN THE UNIVERSITY

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ABSTRACT: *The article is devoted to the study of teaching opportunities of classroom response systems (CRS) and the conditions for their effective use in the teaching process. Four teachers and more than 70 students of Ural State Pedagogical University were surveyed to reveal their attitude to basic CRS abilities. According to the survey, both students and teachers highly appreciate motivation, activating and management functions of CRS. Based on experience with the CRS sets out the conditions for their effective use by teacher.*

KEYWORDS*:* Teacher Feedback, Lecture Response Systems, Management Training, Modern Lecture.

THE RESEARCH PROBLEM

Correct usage of information and communications technologies (ICT) in education allows solving two major didactic problems: education individualization and activation of students' educational activity. The necessity and importance of these tasks were declared long ago although there were no real possibilities of their achievement within traditional scheme of educational process (without means of ICT application). The main reason for this according to B.E. Starichenko is the principle impossibility for one teacher to organize information exchange with many students in volume and efficiency necessary for active educational activity. [1, P. 106-114]. Electronic libraries, distance learning systems, educational disciplines sites, computer control systems, etc. applied at present in universities provide a student with effective access to various and knowingly excessive in contents information resources allowing building individual educational trajectory. The presence and availability of such developed resources is also a condition for activation of educational activity, increase in educational independence, shift of emphasis in educational process building on independent students' work.

Another condition for activation of educational activity is feedback between students and teacher which corresponds to general theory of systems control. In works of many authors (R.F. Abdeev, V.P. Bespalko, A.A. Bratko, D.I. Dubrovskiy, E.I. Mashbitz, B.E. Starichenko) who dealt with informational aspects of educational process the great didactic importance of feedback between students and teacher 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 [1].

The theory of feedback in educational process is rooted in works of E.L. Thorndike written in 1911. It touches upon the issues of feedback model construction in educational process, ef-

fective means and methods of its realization, timing of feedback, feedback learning outcomes [**Error! Reference source not found.**,12,13].

In the control theory for a general case the requirements for information obtained through feedback channels are defined: completeness, adequacy, immediacy. Applied at present means of ICT allow to ensure the fulfillment of all the listed conditions. As shown in works of B.E. Starichenko, N. Davidovich, R. Yavich, the correct organization of informational educational resources and application of modern communication means (in the first place network means) allows not only to improve informational supply and control of educational process within traditional for a university forms of education organization but also generates its brand new forms: remote lectures, seminar-forums, remote consultations, forums for disciplines, means of distant control and self-control, creation and application of wiki-resources [4, 5]. The application of the listed means allows to noticeably change contents and organization of auditorium educational studies of practical character (laboratory works, seminars, practical trainings, control) and particularly independent educational activity.

With this one should point out that there are pedagogical and methodological problems connected with means of ICT application on auditorium lectures that remain unsolved so far. As a rule the application of modern technologies on lectures boils down to computer presentations. There is a lot of works which substantiate the requirements for such presentations and formulate advice on their application[14]. But if a lecturer actively uses such presentations and exhaustive epitomes of his or her lectures (or a textbook) are available on a discipline site it is natural that the following questions arise: How should a modern lecture be constructed? Which educational tasks should be set and achieved on it. There is no necessity to epitomize material which on the one hand frees the class hours, but on the other hand leads to necessity to apply active forms of a teacher's work with an audience. The latter is impossible without the organization of feedback between lecturer and audience as was mentioned above. It is undoubtedly that for a small audience (20-30 people) a lecture can be held out in the form of discussion in which a skilled teacher can involve the whole audience[34]. For a big audience (50-300 people) such form is unacceptable, since the lecturer looses a possibility to monitor the activity of each student.

The presence of feedback with audience enables a teacher to reveal and assess during a lecture the adoption of material by the audience and if necessary to correct the contents of the lecture. A lecturer usually establishes such feedback through questions addressed to an audience: "Is it clear?", "Any questions?", etc. But verbal inquiry of audience when students have to answer publicly as a rule does not reflect the real understanding and adoption of material, which is conditioned by psychological peculiarities of a person's behavior in a big group of trainees.

In connection with the above it seems topical to study the possibilities of application on lectures technical means that could provide the teacher with prompt feedback in big audience conditions and in real-time mode. The problem includes many aspects: technological (*which technical means are necessary?*), contents (*what are the peculiarities of issue presentation and its exposition?*), organizational (*how to organize the listeners' activity?*) analytical (*what should the contents of the information in feedback loop be like and which conclusions on its basis can a teacher make during a lecture?*) – it is obvious that this list can be broadened. Any of the listed aspects can be taken as primary (source) – it will define the decision of the

others. In our research technical and technological possibilities of classroom response systems (they are often called "clickers") were taken as primary position, however, we find it more accurate to call them "classroom feedback systems" (CFS). Such systems are actively applied in educational institutions of the USA and Israel [6-11], whereas the experience of their application in Russia is much poorer. It can be expected that the solution of the problems listed above will make it possible to change in essence the technology of lectures conducting, make it adequate to modern education requirements.

Series of didactic and organizational aspects of CFS application were described in our previous works [2, 3].

One of the important aspects related to the use of feedback systems (as, indeed, any other technological innovations) is the attitude of the teachers and students towards them - rejection of the technology by one or the other party makes use of those technologies inefficient.In this connection we set the goal of our research was to study the ratio of teachers and students to the use of classroom feedback system in the classroom and identify how student's grades are consistent with our expectations.

ORGANIZATION OF THE RESEARCH AND ITS RESULTS

One of the authors of this article was a technical assistant during the spring term of 2010-11 school years for four teachers of Ural State Pedagogical University and helped preparing and conducting lectures with the application of clickers. CFS were regularly applied during lectures on various disciplines (philosophy, pedagogy, psychology, testology) with students from different departments (both humanities and technics).

We supposed (these expectations can be considered as scientific hypothesis, which were verified in our research) that regular and consistent application of clickers when reading lectures will provide with:

- students' educational activity growth during lectures;
- change in lectures contents (particularly nonlinear character of lectures construction);
- solution of some specific for Russian universities discipline problems, particularly, increase the lectures attendance;

To organize discussions and find out the audience attitude with the help of CFS the problem questions were included in lecture presentation materials. At the end of the lecture the questions were used which allow to verify the learning of received material. There were also used some specific for disciplines forms of tasks, for instance, philosophic problems (the "Philosophy" discipline) and interactive psychological experiments (the "Psychology" discipline).

Experience has shown that the optimal interim between two "clicker" questions is 15-20 minutes (i.e. 4-6 questions during a lecture), although there were examples of more particular CFS application if it was required by a lecture contents.

On finishing course of lectures to find out the attitude of students and teachers toward CFS application a questionnaire poll was carried out in which 71 student and 4 teachers took part. Since in the research participated students from pedagogical university, we saw fit to obtain their assessments including those of didactic advantages of CFS. Processing the questionnaire

results consisted in averaging numbers of sample estimation or in defining the percentage of those who have selected this or that variant of answer.

The questionnaire of students gave the following results:

1. *Do you feel that application of clickers during lectures is reasonable and useful?*
   71.8% – yes, undoubtedly;
   21.1% – yes, mainly for the humanities;
   2.8% – yes, mainly for natural-science disciplines;
   4.3% – no, not necessary at all.
2. *Arrange the pedagogical possibilities of clickers in the order of importance (10 – the most important, 1 – the least important).*
   Average assessments (points) among all interrogated made up:
   6.4 – providing with involvement of each student in the course of narration;
   6.2 – prompt feedback between a teacher and audience;
   5.8 – application of active forms, modes, methods of education by a teacher;
   5.7 – instant processing and display of interrogation results;
   5.6 – monitoring of new material adoption;
   5.4 – analytical thinking development;
   5.3 – forming of scientific discussion skills;
   5.2 – accumulating, storing, processing of individual and group interrogation results;
   5.0 – anonymous character of interrogation;
   4.2 – attendance control.
3. *To what extent does the application of clickers by a teacher assist the activation of your work during lectures?*
   53.5% – yes, activates noticeably;
   43.7% – yes, when discussing certain problem questions;
   2.8% – does not assist activation.
4. *Is it important for you to get the evaluation of your answer instantly?*
   63.4% – yes, very important;
   19.7% – yes, if the answer is correct;
   9.9% – no, I am upset by mistaken answers;
   7% – I do not care about marks if they are not recorded in progress register.
5. *Do you think that the result of general vote can influence on further construction of lecture by a teacher?*
   39.4% – yes, it should be this way;
   52.1% – yes, in case of questions with ambiguous answers;
   5.6% – it is undesirable, since there is a deviation from lecture plan;
   2.9% – one can not deviate from lecture plan – the vote should not influence the course of lecture.

The results of interrogation among teachers are as follows:

1. *Arrange the possibilities of clickers in the order of importance (10 – the most important, 1 – the least important).*
   Average assessments (points) among all interrogated made up:
   8.8 – application of active forms, modes, methods of education by a teacher;
   8.5 – providing with involvement of each student in the course of narration;
   8.3 – prompt feedback between a teacher and audience;
   7.8 – instant processing and display of interrogation results;

5.8 – analytical thinking development;
4.8 – monitoring of new material adoption;
4.5 – forming of scientific discussion skills;
3.0 – attendance control;
2.5 – anonymous character of interrogation;
1.3 – accumulating, storing, processing of individual and group interrogation results;

2. *Did you have technological difficulties when preparing presentation materials with the involvement of clickers?*
25% – yes, with software;
25% – yes, when creating lecture structure;
100% – yes, in formulating problem questions;
0% – no, there were no particular difficulties.
3. *Do clickers broaden methodological possibilities for a teacher when reading a lecture?*
75% – yes, undoubtedly;
25% – yes, in several aspects;
0% – no.
4. *Do you agree that application of clickers broaden possibilities for a teacher in directing the course of a lecture?*
75% – yes, undoubtedly;
25% – yes, in several aspects;
0% – no.
5. *What effects that you see in behavior of an audience do you connect with clickers?*
0% – attendance growth;
75% – students' work activation;
25% – growth of interest in discipline;
100% – fascinating, creative atmosphere during lecture;
75% – involvement of each student in the course of narration;
75% – scientific discussions in auditorium.
6. *Do you intend to use clickers in the future?*
75% – yes, undoubtedly;
25% – possibly;
0% – no.
7. *From your point of view what is a main difference of preparing lecture with clickers from traditional one?*
50% – nonlinear character of narration (the course of lecture depends on interrogation results);
75% – necessity of preparing problem questions;
75% – active work with audience;
50% – necessity for teacher to have thorough knowledge of material;
25% – necessity of processing the lecture contents.

DISCUSSION OF THE RESEARCH RESULTS

In our previous works there were singled out groups of main didactic possibilities of clickers: motivational, activating, management [2, 3]. Correlation of questionnaire results with the mentioned groups enables us to make the following conclusions.

The degree of acceptance and approval of CFS technology both by students and teachers is quite high. The overwhelming majority considers their application reasonable and rational; they offer to spread them to other disciplines. We have obtained the following positive comments on the held CFS-lectures from students. "I wish this educational method to be applied more often and on various subjects". "Clickers are very helpful on lectures". "This mode of work is convenient and visual. I liked it very much. It could be more often this way". "It must be applied on every lecture!!!". All participants of educational process admit entertaining, creative atmosphere during lectures. Whereas teachers say it is possible that they will apply clickers in their future work.

1. The activation functions in the work [2, 3] included:

- providing with involvement of each student in the course of narration;
- students' work activation;
- analytical thinking development;
- forming of scientific discussion skills.

This group received many positive evaluations both by teachers and students: more than 97% of students admit growing involvement in the course of clickers lecture; three fourth of teachers observed student's work activation in auditorium – this is seen as main didactic effect of their application, which completely satisfies our initial expectations.

The majority of interrogated understand that CFS application requires new approaches from a teacher to lecture construction. Particularly, its narration will cease to be linear, since due to character of answers on problem questions with ambiguous solutions, selected by the majority of students, its further course of narration may change. This in its turn makes higher demands for scientific and subject horizons from a teacher, for his or her ability to orientate in educational situation and make adequate pedagogical decisions[22,27,30]. A lecturer is no more a translator of educational texts according to a plan complied beforehand!

Preparing of good problem questions which can be considered as "branch point" in the course of a lecture turns out to be an uneasy task, which, on the one hand, requires good knowledge of educational material from a teacher, and on the other hand, prognosis of possible students' reaction on these questions. The difficulties connected with finding situations where it is reasonable to apply problem question as well as directly with question wording are admitted by all teachers. It turns out important to correct the problem questions having tested them during a lecture.

The motivational functions according to [2, 3], include:

- students attendance control in auditorium;
- creating interactive, fascinating atmosphere in auditorium;
- anonymous character of interrogation;
- monitoring of new material adoption by students.

Even though both teachers and students placed these possibilities of clickers in the middle of the importance list, all teachers observed creative, fascinating atmosphere in auditorium. It is interesting to admit that anonymity of interrogation that from our point of view is one of the key characteristics of CFS has received scarce evaluation [14, 19, 32]. The noticeable influence of CFS application on lecture attendance was not observed by teachers, whereas students put this function of clickers on the last place of importance. From our point of view this circumstance is connected not with clickers but with organizational conditions of education

(in particular with the point that in many Russian universities attendance of classes is not obligatory even for full-time tuition students and it is not directly connected with final progress rates).
The group of management functions included:

- prompt feedback with audience regardless of its size;
- concurrent gathering of all listeners interrogation results;
- instant processing and display of interrogation results in the form convenient for further analysis;
- possibility of viewing and analysis of individual answers, and group regularities identification;
- accumulating, storing, and further processing of individual and group interrogation results.

The statement that clickers significantly broaden teacher's possibilities of managing the course of lecture received a brilliant confirmation in practice. This group of possibilities has a principle importance: students can be activated and motivated without clickers, but the course of lecture cannot be completely managed without them.

Teachers admit difficulties, connected with CFS technology application. AS shown above they are mainly formulating the problem questions and nonlinear character of lecture construction. Apart from this the difficulties were admitted connected with peculiarities (and imperfections) of applied clickers software (QOMO HiteVision QFR600). Finally, direct lectures conducting requires the presence of technical assistant, which makes it impossible to apply the technology on a mass scale.

Thus, the significance of the present study we see in the proof of the fact that , on the one hand , it is impossible to ensure the active work of students in class where there is a high number of them without the use of technical means (such as voting systems) . On the other hand, the use of such a well-organized system receives very positive feedbacks from both teachers and students. Both of these circumstances create a prerequisite for rethinking established at the universities views on the construction of lectures and teaching accents in them.

CONCLUSION

Modern lecture should be high-technology, providing with maximum efficiency of educational information transfer and adoption. The held research, the results of which are given in the article, shows that basic and most expected pedagogical effects of CFS application are indeed realized[23-32]. At the same time there were revealed problems, the solution of which requires further scientific research – they are mainly detecting ambiguous situations and managing the audience in the process of their solution. Apart from this, it is of interest to study the specificity of clickers lectures construction for the humanities and natural sciences as well as features of such lectures construction when working with students from the humanities and the technics departments. We plan to cover these issues in our further researches.

REFERENCES

Biton, Y. (2011). Incorporating peer assessment in pre-academic mathematics study. Thesis of Doctor of Philosophy. The Department of Education in Science and Technology, Technion, Haifa.

Biton, Y. & Koichu, B. (2011).Peer assessment and mathematical creativity. In Avotina, M., Bonka, D., Meissner, H., Ramana, L., Sheffield, L., Velikova, E. (Eds). Proceedings of the 6th International Conference Creativity in Mathematics Education and the Education of Gifted Students. pp. 30-34. Latvia: Latvia University.

Crouch, C. H. Peer Instruction: Ten years of experience and results [Text] / C. H. Crouch, E. Mazur. // Am. J. Phys. –2001. – Vol. 69. – № 9. – P. 970-977.

Стариченко, Б. Е., МАХРОВА, Л., ДАВИДОВИЧ, Н.,& ЯВИЧ, Р. (2007). Управление учебной деятельностью студентов на основе сетевых информационных технологий. Образование и наука, (6), 48.

Davidovich, N., & Yavich, R. (2013). Course websites and their contribution to students' evaluation of instructors and their courses. Research Journal of Management Science, 2(3), 1–7.

Domoshnitsky Alexander and Roman Yavich, Mathematical Competitions for University Students, Proceedings of the 10th International Conference Models in Developing Mathematics Education, Dresden, Saxony,Germany, 143-145 (2009)

Domoshnitsky, A. & Yavich, R. (2011). Internet mathematical Olympiad for students, mathematics competitions, Journal of the World Federation of National Mathematics Competitions Organizers, 24(1), 11–21.

Domoshnitsky, A., Yavich, R., Bugaenko, V., & Kannel-Belov, A. (2012). International mathematical internet Olympiad. Journal of Systemics, Cybernetics and Informatics, 10(5), 50–54.

Domoshnitsky, A. & Yavich, R. (2009). Intemet Mathematical Olympiads. Dresden: HTW.

Davidovich, N., Yavich, R. & Domoshnitsky, A. (2012). Mathematical games: International mathematics Olympiad for students.Far East Journal of Mathematical Education,9(2), 133–140.

Domoshnitsky, A. & Yavich, R. (2009). Mathematical competitions for university students, Proceedings of the 10th International Conference Models in Developing Mathematics Education, Dresden, Saxony, Germany, pp. 143–145.

Domoshnitsky, A. & Yavich, R. (2009). Internet Mathematical Olympiads. Proceedings of the 10th International Conference Models in Developing Mathematics Education, Dresden, Saxony, Germany.

Domoshnitsky, N. Keller, R. Yavich, Mathematical Debates as a Game Method of Teaching Mathematics // The 17th World Multi-Conference on Systemics, Cybernetics and Informatics:
WMSCI2013_(http://www.iiis.org/CDs2013/CD2013SCI/SCI_2013/PapersPdf/DW366XY.pdf) International Inst. of Informatics & Systemics,USA

Fies, C. Classroom Response Systems: A Review of the Literature [Text] / C. Fies, J. Marshall. // Journal of Science Education and Technology. – 2006.
–Vol. 15. –№ 1. – P. 101-109.

G.A.Goldin et al. Beliefs engagement structures: Behind the affective dimension of mathematical learning. ZDM Mathematics Education (2011) 43 : 547 – 560

Lasry, N. Clickers or Flashcards: Is There Really a Difference? [Text]/ N. Lasry // The Physics Teacher. – 2008. – Vol. 46. – P. 242-244.

Martyn, M. Clickers in the Classroom: An Active Learning Approach [Text]/ M. Martyn. // Educause Quarterly. –2007. – № 2. – P. 71-74.

Mayer, R.E. Clickers in college classrooms: Fostering learning with questioning methods [Text]/ R.E. Mayer, et al. // Contemporary Educational Psychology.– 2008. – P. 1-7.

Mory, E.H. (2003). Feedback Research Revisited. In D.H. Jonassen (ed.), Handbook of research for educational communications and technology, 2cnd Edition (pp. 745-783). Mahwah, NJ: Lawrence Erlbaum

Nitza Davidovich, Roman Yavich and Alexander Domoshnitsky, Mathematical Games: International Mathematics Olympiad for Students, Far East Journal of Mathematical Education, 9(2), 133-140 (2012)

Nitza Davidovich, Roman Yavich. "Social - Academic Climate in Online Learning Environments ". Journal of Studies in Social Sciences ISSN 2201-4624 Volume 5, Number 1, 2013, pp.106-119

Nitza Davidovich, Roman Yavich. " Social - Academic Climate in Online Learning Environments ". Journal of Studies in Social Sciences ISSN 2201-4624 Volume 5, Number 1, 2013, pp.106-119

Roman Yavich, Social networks and students, Research Journal of Management Sciences, Vol. 2(2), 1-2, February (2013), pp. 1-3

Starichenko, B.E. Conceptual basics of computer didactics: Monograh: Yelm, WA, USA. Science Book Publishing House, 2013. – 184 p.

Starichenko, B.E. Computer technologies in the issues of educational systems optimization [Text] / B. E. Starichenko - Yekaterinburg: USPU, 1998. – 208 pp.

Starichenko, B.E., Starichenko, E.B., Egorov A.N. Organization of feedback between students and teacher in the system of videoconference communication. / Application of information and communication technologies in education. Intercollegiate collection of scientific works / Shadrinsk state pedagogical institute, Shadrinsk, 2010. – P. 312-320.

Starichenko, B.E., Starichenko, E.B., Egorov A.N., Davidovich N., Yavich R.P. Auditorium interrogation systems in a teacher's lecture work / Innovation techniques in educational process of higher school: Materials of VII international scientific conference / USPU. – Yekaterinburg, 2010. Part 1– P. 77-82.

Starichenko B.E., Egorov A.N., Yavich R. Feautures of Application of Classroom Response System at the Lectures in Russia and Israel// International Journal of Higher Education – 2013, – Vol. 2, – № 3. P. 23-27.

Starichenko, B. E., A. N. Egorov, N. Davidovitch, and R. P. Yavich. "Classroom survey systems in teacher lecturing." Innovative Technologies in Higher Education (2012)

Yavich R.P. Managing student's educational activity on the basis of information technologies [Text] / R.P. Yavich, B.E. Starichenko, L.V. Machrova, N. Davidovich // Education and science: Proceedings of the Ural department of Russian Academy of Sciences – 2007. – № 6. – P. 3-15.

Yavich R.P. Managing the mathematical training of students from technical university on the basis of telecommunications technologies [Text] : thesis of candidate of pedagogical sciences / R. P. Yavich. – Yekaterinburg, 2008. – 183 pp.

Yavich, R.(2013). Social networks and students, Research Journal of Management Sciences, 2(2), 1-2, 1-3.

Yavich, Roman, and Alexandra Gerkerova. "Teaching Methods and Assessment." American Journal of Educational Research 1.7 (2013): 260-262.

Явич, Р. П., et al. "Управление учебной деятельностью студентов на основе сетевых информационных технологий." Образование и наука. Известия Уральского отделения Российской академии образования 6 (2007): 3-17.