Quality Assurance of Teacher’s Pedagogical Techniques by Means of Information Technologies

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1. Introduction

1.1 Introduce the Problem
Informatization of modern society has led to the use of alternative sources of information in the educational process and to the development of new educational methods and means. The use of information technology helps in a more natural way the student to switch from being a passive observer and listener to being a researcher, which is particularly important in the conditions of the modern educational paradigm. All this necessitates review and change of means of educational technologies, including increase of the efficiency of teacher’s pedagogical techniques on the basis of operational monitoring of the individual requirements of the student, society and state to the education system.

Providing the teachers with the right to form pedagogical techniques by themselves involves the fulfilment of their own personal and professional needs. There is a need to develop rapid, sensitive ethical techniques in order to ensure the quality of teacher’s pedagogical techniques.

Traditional methods of finding of deficiencies in teacher’s pedagogical techniques (students interviewing and questioning, etc.) are hardly suitable for use due to their labor and time costs and do not allow ensuring the process efficiency. It is possible to eliminate this disadvantage by using the information technology. Thus, the use of information technology will allow faster receiving and studying the opinions of students about the teacher’s pedagogical techniques, as well as creating and filling the database of their positive and negative features.
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This article describes the technology of assurance of the quality of pedagogical techniques by means of its self-correction by the teacher, providing him with the possibility to maintain his individuality and at the same time to improve by himself his pedagogical techniques. In such conditions, teacher’s pedagogical techniques will timely respond to different educational innovations and will meet the needs of students, society and state.

1.2 Explore Importance of the Problem
Modern studies consider a wide range of issues related to the improvement of teacher’s pedagogical activity. Analysis of the works over the last few years has shown that the problem of assurance of the quality of educational technology by means of its self-correction by the teacher using the information technology has not been yet fully studied in pedagogical science and practice.

As per the works of national and foreign authors, the main distinctive feature of improvement of pedagogical techniques is the use of various sequences of actions: “From the general to the particular and then to the practice” and “from the particular to the generalization of techniques and then to the practice” respectively (Figure 1).

1.3 Describe Relevant Scholarship
Guidelines for teachers on self-correction of their pedagogical techniques are formulated and others. However, these recommendations are empirical and do not have a mathematical basis. The study of teaching quality with the use of qualimetry is described in the works of and others. The questioning-based research has been conducted and other scholars. We have to note that the questioning method has a number of disadvantageous features, such as the possible impact of the wording of questions and answers on the respondent’s choice, the collection of information in the “unnatural” conditions (Lapierre paradox) and others. It is possible to eliminate some of these imperfections by using information technologies. All qualimetry researchers notice the importance of the use of information technologies to improve teacher’s pedagogical techniques. At the same time, the need to create and improve the informational and communicative competence of teaching staff is today an urgent task.

Having noticed the importance of the conducted researches regarding the improvement of teacher’s pedagogical techniques, we have to emphasize however, that the technology of self-correction by the teacher of his own pedagogical techniques using computer programs has not been yet developed, as the issues of pedagogical techniques quality assurance by means of self-correction by the teacher have not been comprehensively studied.

1.4 State Hypotheses and their Correspondence to Research Design
The words “pedagogical techniques” are understood as “the system of a large number of skills that allow the teacher using his body as an instrument of influence: By means of his voice, plastic, facial expressions, rhythm, vocabulary, costume the teacher creates the image of his personal “self” and makes a real picture of relations experienced by the teacher and perceived by children” and the system of the teacher’s general pedagogical abilities to organize an optimal communication with the students.

Explains the meaning of the term of “correction” as the process of “detection of deviations in the expected activity results and introduction of changes in the activity in order to ensure the necessary results”. It is possible to reduce discomfort (fear, anxiety) of corrective actions by means of self-correction as there are no external subjects involved in the correction process. The term “self-correction” means “a common didactic teaching method, which consists in independent correction of errors”.

We consider it appropriate to provide the teacher with an opportunity to correct the errors in his own pedagogical techniques, taking into account the opinion of students and other teachers that will allow distinguishing the positive and negative methods of pedagogical techniques of the teacher. Based on the obtained techniques characteristics, a database of positive and negative methods of teacher’s pedagogical techniques is formed. The use by pedagogical workers of the database for self-correction their techniques help to enhance the positive and reduce the negative impact of the teacher’s techniques on students. We shall note that the offered possibility to compare the teacher’s pedagogical techniques with the techniques appreciated by students will allow each teacher to enhance the advantageous features and minimize the disadvantageous features of his pedagogical techniques and by doing so to personalize it even more.
2. Method

2.1 Identify Subsections
Existing software is not able to completely solve the problem of self-correction by the teacher of his pedagogical techniques. So, the shooting of the teacher’s actions can be done in various ways, having significant disadvantages. If the shooting is carried out by using an analog video camera, the record received will need to be digitized by means of special equipment. This usually causes the image quality loss. Further actions are similar to the ones when working with a digital camera. If we record the teacher’s pantomimicry by digital cameras, cameras with video recording function, then in order to transfer the captured pictures, we will need a special cable, knowledge of programs, time and numerous hardware resources. As a result, it was decided to use a webcam connected to the computer.

Another example is related to such a component of the teacher’s pedagogical techniques as the sound of the voice and elocution (euphony, versatility, melody, lasting, etc.). In order to study some characteristics of teacher’s voice, for example, the frequency (number of sound vibrations per second), it is advisable to use information technologies. The existing diversity of both paid and free software products for sound processing can be used, for example, for noise reduction (which is important for the study of the sound of teacher’s voice among the voices of students), sound cutting, copying, etc. The disadvantage of these programs in the context of self-correction by the teacher of his pedagogical techniques is the complexity of the audio information processing, requiring further development of guidelines for a more detailed study of the teacher’s voice sound. Thus, existing software can only partially solve the problem of self-correction by the teacher of his pedagogical techniques. There is a need for development of a special software.

Developed by the author computer programs for the technology of self-correction by the teacher of his pedagogical techniques14-16 are based on logical relations, qualimetry theory, mathematical methods. Stages of work with the software are reproducible and guarantee the achievement of the expected results: The formation and use of the database of the teacher’s positive and negative pedagogical techniques identified with regard to the collective opinion of the students and other teachers.

“The student’s opinions registration software” makes it possible to record the opinion of the students and other participants of educational relations regarding the teacher’s pedagogical techniques16. As a result of the software operation, the empirical data on evaluation of teacher’s pedagogical techniques by students and other participants of educational relations are entered into spreadsheet tables (depending on the software installed on the working computer), where they will be then processed. The software for the assessment of results of evaluation of the pedagogical techniques of the teacher15 on the basis of empirical data analysis allows us to generate a database of positive and negative pedagogical techniques of the teacher.

Here is an example of the use of the database of positive and negative pedagogical techniques of the teacher in the process of self-correction by the teacher of his pedagogical techniques. For this purpose, the author’s software for “the study of the trajectory of the teacher’s movement in the classroom” is used, which allows us examining the trajectory of the teacher’s movement in the classroom by entering the empirical data of the research shooting and database of positive and negative pedagogical techniques of the teacher (trajectories), formed on the basis of the collective opinion of the students and other participants of educational relations16. As a result of the software operations, two files are generated: A text file containing the report indicating the time of positive and negative teacher’s movement trajectories and a graphic file, representing the visualized evaluation of trajectory of the teacher’s movement in the time terms.

2.2 Participant (Subject) Characteristics
The following experts have participated in the formation of the database of positive and negative pedagogical techniques of the teacher: Students, teachers, parents (legal representatives), administration of the educational organization. The requirements to the experts were the following: Possession of innovation-friendly attitude, absence of conservatism (the desire to adhere to a once-for-all-time position) and conformity proneness (the adoption of the majority opinion).

2.3 Sampling Procedures
The studies were conducted in the real-life conditions. Selection of groups of candidates for experts, their
Quality Assurance of Teacher's Pedagogical Techniques by Means of Information Technologies

personal details have been held by the method of analysis of hierarchies\(^7\). The candidates for experts have been divided into groups as follows: Students (of the 7, 8, 10 grades), teachers, parents (legal representatives) and administration. Also, competence profiles (Tables 8-10) for each group of candidates for experts have been formed. The following group of candidates in the experts were identified. The Kendall's coefficient of concordance have been used to assess the concordance of opinions of the candidates for experts. For calibration of candidates for experts, the known pedagogical techniques of the teacher have been used. An example profile with the performed normalization is shown in Table 1.

Table 1. Example profile of candidates for experts from the student group

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Rank</th>
<th>Answers</th>
<th>Generalized rank</th>
<th>Sum of answers in expert group</th>
<th>Standardized answers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CE1</td>
<td>CE2</td>
<td>CE3</td>
<td>CE1</td>
<td>CE2</td>
</tr>
<tr>
<td>1</td>
<td>B students, A students</td>
<td>3</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>Number of victories in competitions, contests, sports competitions etc.</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>3</td>
<td>Participation in school organizations work, in events</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>0.2</td>
</tr>
<tr>
<td>4</td>
<td>Experience of working in commissions</td>
<td>1</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Assessment of the competence of candidate for experts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Results

3.1 Statistics and Data Analysis

The instrument of self-correction by the teacher of his pedagogical techniques has been experimentally tested. We are presenting below the grounding of objectivity of the results and reliability studies; as well as of the quality of the instrument of self-correction by the teacher of his pedagogical techniques.

Assessment of the validity and reliability of the software developed for teacher’s self-correction of his pedagogical techniques has been tested. Reliability of the instrument (saving of all parameter values within the established limits during the whole time) has been achieved as a result of a long-term study, multiple testing of the given software, ensuring almost complete reproducibility of the experiment under the same conditions. To ensure the internal validity of the instrument (compliance of the real study with the ideal one), the tests have been conducted in actual conditions, without using any foreign subjects and objects, atypical for the educational process. Proof of construct validity (compliance with the true expectation, efficiency) has been obtained after numerous experiments with the identical results. Operational validity (degree of correspondence of the experiment plan to the tested hypotheses) of the described software has been proved by assessing the consistency of the collective opinion of students and other participants of educational relations as well as the existence of a relationship between the teacher’s pedagogical techniques and collective opinion. For this purpose, the concordance coefficients and rank correlation have been calculated. Evidence of the existence of external validity (the extent to which the results of a particular study can be applied for many teachers) is the fact that testing of the developed software have been carried out in the real-life conditions with a large number of additional variables: Different types of educational institutions, different age groups of teachers and students, teaching styles, life values of students, etc. In the presented experiments, the criterion validity (i.e. how the experiment results correlate to several already known teacher’s pedagogical techniques) has been controlled by regular comparison of the research results with existing recommendations. Throughout the experiment, the results of study corresponded to the existing concepts of teaching techniques.

The effectiveness of self-correction by the teacher of his pedagogical techniques has been assessed by calculating the criteria of the social, ergonomic and economic effectiveness.

For example, the criterion of social cooperation of students and teachers is calculated as follows:
\[ K_1 = \frac{N_1}{N} \cdot 100\% \]

Where \( K_1 \) - Social cooperation criterion; \( N_1 \) - Number of students and teachers noticing the presence of social cooperation; \( N \) - Total number of questioned teachers and students.

The survey results are given in Table 2.

<table>
<thead>
<tr>
<th>Subjects of the educational process</th>
<th>Number of students and teachers noticing the presence of social cooperation</th>
<th>Total number of questioned teachers and students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>1537</td>
<td>1825</td>
</tr>
<tr>
<td>Students</td>
<td>1105</td>
<td>1563</td>
</tr>
<tr>
<td>In total</td>
<td>2642</td>
<td>3388</td>
</tr>
</tbody>
</table>

**Conclusion:** The criterion of social cooperation of students and teachers has been assessed as “good”.

The controllability criterion \( (K_2) \) as the effectiveness with respect to the time given for the improvement of the teacher’s pedagogical techniques is determined using the following formula:

\[ K_2 = \frac{100\%}{T_1 - T_0} \]

Where \( T_1 \) - The time spent on the improvement of teacher’s pedagogical techniques without the use of the technology of self-correction by the teacher of his pedagogical techniques.

Groups of teachers, including trainee teachers, have agreed to learn specific pedagogical techniques using the described technology and without it. The mandatory condition was to record the comments and the time spent in the course of the entire process. The analysis of experimental data has shown that the teachers regularly recorded significant reduction in the time needed for the learning of pedagogical techniques using the technology due to the possibility of feedback, the possibility to obtain an operational assessment of their actions by the participants of educational relations, as well as the possibility to see themselves through others’ eyes.

The criterion of teacher’s costs for improvement of his pedagogical techniques \( (K_3) \) is determined by the following formula:

\[ K_3 = C^0 - C^1 \]

Where \( C^0 \) - Teacher’s costs for improvement of his pedagogical techniques without using and without use of the technology of pedagogical techniques self-correction.

The teacher’s costs for improvement of his pedagogical techniques without use of the technology are calculated as follows:

\[ C^0 = C_m + C_l + C_o \]

\( C_m \) - Cost of materials: the scientific and methodological literature, purchase of application software for the study of pedagogical technology, etc.;

\( C_l \) - Labor costs: Payment for the work of teachers, students and other participants of the educational process, taking part in the process of pedagogical techniques improvement;

\( C_o \) - Overhead costs: Payment for the Internet, PC and office equipment maintenance and so on.

The teacher’s costs for improvement of his pedagogical techniques using the technology:

\[ C^1 = C_l + C_o \]

\( C_l \) - Labor costs: Payment for the work of teachers, students and other participants of the educational process, taking part in the process of pedagogical techniques improvement;

\( C_o \) - Overhead expenses.

**Conclusion:** Having compared the costs, we can see that there is a cost cut when using the technology of self-correction of pedagogical techniques due to the absence of expenses for materials.

Let us consider the use of the technology of self-correction by the teacher of his pedagogical techniques to ensure the quality of pedagogical techniques of teachers working with certain categories of students.

The results of the technology used when interacting with persons who have shown outstanding abilities and with persons with disabilities are described in[18]. Our work[19] contains the conclusions regarding the use of technology of the quality assurance for pedagogical techniques when...
working with certain categories of students from different ethnic and cultural backgrounds.

The term “ethnic tolerance” means a person’s ability to tolerate the unfamiliar way of life of other ethnic community representatives, their behavior, national traditions, customs, feelings, ideas, opinions, beliefs and so on[20]. Manifestations of tolerance in the educational process depend on the individual understanding/misunderstanding, acceptance/non-acceptance of specific character of behavioral responses of teachers and students of different ethnic groups. The problem of tolerance has arisen due to the different religious beliefs, so the risks of intolerance among the participants of the educational process are always present in the relationship between people of different cultures and ethnicity. Teaching and interaction of teachers with the representatives of various ethnic groups of students are carried out on both the verbal and nonverbal levels. It is not a secret that certain expressive gestures in different ethnic groups and nations have different semantic meaning (the thumb extended upward, shake of the head, a finger touching the nose, etc.). Teaching without due regard to the importance of ethnic characteristics of certain gestures, pantomimicry and intonation for each specific nationality of participants of the educational process, leads to a prolonged educational process, lack of mutual understanding and cooperation between the participants of the educational process and causes uncomfortable conditions of the educational process[21,22].

In the course of the technology evaluation, teachers were asked to answer a series of questions formulated in accordance with the questions of the “Measurement of tolerance in the field of inter-ethnic relations” test[23] and adapted to the subject of study.

Here are some results of the survey. Answers to the question “Please assess your technique: Do you show ethnic tolerance towards your students in your work?” before the study of the technology and after that are presented in Figure 2.

When giving the answer to the question “What are you guided by when choosing the way of your behavior when you communicate with students other than your ethnic group?” the teacher wrote: “my own experience” (44%), “intuition” (49%), “nothing” (7%). The results show that when choosing the way of their professional behavior, the teachers are guided basically only by their own ideas about other ethnic groups. Analysis of experimental data before and after the questioning of teachers has shown a decrease of “Always” answers by 20%. According to teachers who have participated in the experiment, this is due to the fact that before the study, they were guided mostly just by their intuitive ideas. Teachers did not have the opportunity to promptly receive an evaluation of their techniques based on the opinions of students belonging to different ethnic groups and their parents (legal representatives).

4. Conclusion

In summary, we can say that the importance of the use of information technology in the process of self-correction of pedagogical techniques by the teachers is determined by the active implementation in the educational process of new forms of teaching, various multimedia, networking technologies, etc. Experimental testing of the described software in order to ensure the quality of pedagogical techniques has proven its significance. The study of the opinions of students, their parents and other teachers can be carried out much faster and with a greater degree of reliability when using the information technologies.

5. References

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