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VIRTUAL PROFESSIONAL PRACTICE FOR TEACHERS OF THE DEAF “DIAGNOSIS OF DEVELOPMENT OPTIONS OF YOUNG CHILDREN WITH IMPAIRED HEARING”

T. V. Nikolaeva¹

1. Institute of Special Education of the Russian Academy of Education,
Pogodinskaya Street, 8/1, Moscow, Russia, 119121

Abstract. The article focuses on the problem of development and application of information technologies in teaching students of teachers' of the deaf department. The purpose of the study is to develop and justify an approach to design and use of virtual practice for students aimed at mastering the process of diagnostic study of hearing-impaired children. The author has highlighted the professional competence of a teacher of the deaf in the field of developmental educational diagnostics of children in the individualized remedial education context. The author has defined the general principles of designing virtual practice aimed at mastering a specific diagnostic technique. The author has also created an experimental model of virtual practice and has tested it among university students. The author has proved a fundamental increase in the effectiveness of the formation of professional competences of students in the field of diagnosing the development of children with hearing impairments. It is critically important to use the virtual practice of this type. The proposed approach to the design of virtual practices opens the prospects of creating virtual professional practices of this type in other areas of training for teachers of hearing-impaired children and other pathologists of various profiles.

Keywords: information technologies, virtual professional practice, hearing aid students, hearing-impaired children

1 Introduction

There is much evidence that the application of information and communication technologies (ICT) in the system of continuous specialist education, including the education of special education experts, is relevant both in Russia and abroad. Modern ICT have a powerful educational potential, they offer a wide range of possibilities, they allow the implementation of technological tools and learning environments. Experts believe that the use of ICT in the educational process significantly increases the motivation of students to learn. It provides a more effective interaction between a teacher and students; it facilitates a conscious approach to professional activity and more reliable assimilation of knowledge and skills in the studied area ^{[1], [2], [3], [4], [5], [6], [7]}.

The problem of improving the quality of education using ICT is inseparably linked with the problem of forming the professional competences of teachers who train future specialists in defectology. Specialists note the importance of studying the attitude of educators and teachers to the use of electronic teaching tools, expanding their knowledge and understanding of the possibilities of introducing and using ICT in the educational process ^{[5], [6], [8], [9], [10]}. The Institute of Special Education of the Russian Academy of Education has developed a methodology for the use of ICT in the system of continuous education of special education experts of different profiles. The choice of electronic tools is substantially verified and includes interactive models of normal ontogenesis, electronic libraries demonstrating children's cases, the interactive models of practical work of a special education expert with a child, virtual practices of examining and correctional work. Design engineers developed the products, based on principles and design common for different correctional profiles ^[1]. ^[11]. The proposed methodological approach has been successfully implemented in electronic tools for preparation and further training of speech therapists ^{[2], [12]}. The significant increase in the effectiveness of forming the professional competences of speech therapists emerges in cases when correctional workers use virtual libraries for studying children's cases. They follow interactive models of professional work with a child and his/her family and analyze professional virtual practices. However, no research has been conducted so far in the field of the use of ICT in the system of continuous education of teachers for the deaf. Inadequate attention has been paid to the development and application of electronic tools for the formation of professional competences, the readiness to apply the knowledge in working with a hearing-impaired child and his/her family.

The purpose of the research is to develop an approach to the creation and application of virtual professional practices in the system of continuous education of teachers for the deaf. The research hypothesis implies the assumption that improving the quality of the professional competences of students in the field of diagnostic activities emerges from the development and application of professional virtual practices.

2 Methods

The basic methodology is the application of ICT to form the professional competences of an intended special educator. Of much importance is the presentation of electronic tools necessary to form a student's preparedness to apply special education knowledge to the practice of working with a child^[2].^[12] The methods used in the research are as follows: design method, training and control experiment, quantitative and qualitative analysis of experimental data, questionnaire.

3 Results

The research resulted in a specific virtual practice, i.e., the methodology of instructional examination of young children with hearing impairment aimed at determining the options for their development.

The general principles of virtual practice design target the mastering of a specific diagnostic technique by a teacher of deaf and hard of hearing children. The principles are as follows:

- identifying and accurately describing the formed competences and skills;
- distinguishing the general and specific professional competences of teachers working with deaf and hard of hearing children;
- coordinated and simultaneous formation of general correctional and specific teachers' of the deaf representational abilities and skills;
- sequential formation of selected notions and skills during the practical work of a teacher of deaf and hard of hearing children in the field of educational diagnostics;
- operational composition of each skill;
- modeling and video shooting of episodes of professional activities of the teaching faculty; in the videos, one can find the application of each formed skill and component;
- modeling and videotaping episodes of work of a supervisor, demonstrating correct and erroneous actions of a specialist in the process of pedagogical examination;

- determining the necessary and appropriate notions, which are indispensable for the formation of the required competence in the course of representation of children's cases;
- modeling and videotaping episodes of the behavior of children with hearing impairment in the process of pedagogical examination;
- developing requirements for videotaping, considering the specificity of the diagnostic methodology and the criteria for assessing the behavior of a child;
- developing requirements for a stimulant material reflecting different aspects of the examination process, i.e., the variants of children's behavior, options for the correct and erroneous behavior of the faculty in the examination process, opportunities for interaction, etc.;
- determining the productive types of educational activities involving both students and the faculty for mastering of each class of problems;
- determining the kinds and types of training exercises necessary and appropriate for the formation of specific professional competences;
- feedback, i.e. providing a student with data on the quality of the process and the results of study assignments;
- providing variable care at any stage of a student's work with virtual practice.

The focal subject field of virtual practice research is the method of complex pedagogical examination of a young child with hearing impairment^[13]. According to the proposed method, pedagogical examination of a child with hearing impairment is the initial stage of training, in the process of which a teaching expert determines both the overall level of a child's development and his/her individual characteristics against the background of his/her growth. The set of tasks includes the study of social, physical, cognitive development, as well as a child's play activity, the state of his/her hearing and speech. We developed the content and procedure of the examination, as well as the criteria for assessing the performance of children for each developmental line. The integration of diagnostic data according to specified principles makes it possible to identify the variants of the development of a child with hearing impairment that are meaningful for the individualization of training programs, i.e., harmonious development, underdevelopment, uneven development.

We realized the practical activities' analysis describing a teacher of the deaf and hard of hearing children using the chosen method for diagnosing the development of young children with hearing impairments. Consequently, we offered a set of guidelines for the correct application of this

methodology, its general and specific components necessary for the education of special needs teachers. The guidelines are as follows:

- understanding, according to which, the meaning of a child's examination is not a conclusion about the identified variant of development, but the adaptation and individualization of a child's educational program based on the conclusion and data collected during the diagnosis;

- understanding that the teaching faculty does not have the right to limit the activity to examining hearing and speech, but should get a holistic picture of a child's development;

- understanding that pedagogical examination of a young child with hearing impairment does not begin with the presentation of tasks, but with the establishment of emotional contact;

- understanding that adequate application of this technique targets a long period of time necessary for a child's examination (from 1-2 weeks to 1-1.5 months);

- understanding that this technique requires identification of not only the actual level (independent achievements demonstrated without the help of adults) but also the zone of proximal development (achievements demonstrated with the support of an adult, in conjunction with an adult's involvement);

- understanding that this technique requires examining each line of development, identifying the actual level and area of a child's immediate development;

- understanding that to identify the development option for a hearing-impaired child it is necessary to integrate all data from the examination of all developmental lines;

- understanding and expecting differences in the achievements of children in the field of development, the complex relationships of these achievements in the overall picture of a child's evolution;

- understanding of the danger of underestimating the capabilities of a hearing-impaired child who suffers from insufficient verbal means of communication;

- ability to present tasks in accordance with the requirements of the methodology;

- ability to introduce a child to a diagnostic task, using all available means of communication, including natural gestures;

- ability not to regard a refusal to perform a task as the reason for a negative assessment;

- ability to assess and describe the emotional and behavioral reactions of a child during the examination;

- ability to analyze the behavior of a child in the process of examining the specified criteria area, i.e., the acceptance of the assignment, the degree of independence in the performance of the task, the interest in the process and the result of the activity;

- ability to analyze the result of each diagnostic task, determining the degree of its compliance with a given pattern;

- ability to maintain the examination protocol according to the set methodology requirements;

- ability to put forward a preliminary hypothesis about a child's developmental level describing each evolutionary line under study. The tasks must correspond to the age level;

- ability to check the working hypothesis necessary for the further examination of a child based on fulfilling additional tasks, which are "below" or "above" the age norm;

- understanding that the result of the tasks performed by a hearing-impaired toddler depends largely on the ability of a teacher to find the correct instruction; the instruction must stem from a child's real achievements in development and the evaluable means of communication with a child;

- ability to evaluate and describe a child's communication tools and their correlation for an adequate assessment of the activity of a child with hearing impairment during the examination;

- understanding that the level of development and the degree of its harmonious perception by a hearing-impaired child does not directly depend on the state of hearing; obviously, children with similar primary hearing impairments may demonstrate different developmental options;

- ability to integrate data from different developmental lines and draw conclusions based on the development options identified by the methodology;

- ability to compile a psychological and pedagogical description of the development of a hearing-impaired child based on the methodological structure and data collected.

The developed methodology helped us identify the required skills that emerge in virtual practice, i.e., the ability of a supervisor to observe the requirements of the methodology during the examination of a child, the ability to analyze a child's behavior according to the criteria set by the developed methodology, the proficiency to propose a hypothesis and check it, the skill to integrate the data obtained and reflected in the examination report and the proficiency to make a conclusion on the development of a hearing-impaired child.

When designing virtual practice, we applied the principles for selecting children's cases, which are as follows:

- hearing-impaired children with the most common, typical and often encountered in practice development options;
- hearing-impaired children with similar pronounced primary hearing impairments, e.g., the hardness of hearing, deafness, but with different development options;
- hearing-impaired children with a similar variant of development but with the difference of hearing aids, e.g., hearing aids and cochlear implants.
- exclusion from the sample case group of those hearing-impaired children who have additional developmental disabilities;
- the most common in the process of psychological and pedagogical examination behavior cases, which often emerge in practice and which are typical of the conduct of children with hearing impairment.

To develop a pilot experimental sample of virtual practice, we chose a children's construction activity. The basis for the choice was the following considerations. Using construction materials is a kind of activity that can be visible, its process and result are clearly observable and, therefore, easily analyzed by students. Using an example of this type of child's practical activity, it is possible to form both general correctional and necessary teachers' of the deaf skills in the field of instructional diagnostics of children's development.

In accordance with the rules of methodology for the examination of constructive activities, we applied two series of tasks, i.e., basic and additional. The main tasks focus on the age of a child. For example, if a child is 2 years and 3 months old, we examined him/her with the assignments intended for children aged 2-2.5 years; if a child is 2 years and 8 months old, we gave him/her the tasks intended for children aged 2.5-3 years. Extra tasks are beyond the age-matched correspondence. We offered a child additional tasks above the age requirements if he/she successfully deals with a series of basic tasks corresponding to his/her age. We offered additional tasks below the age requirements in the case when even after the help of a teacher a child is not able to complete most of the basic tasks corresponding to the age. Consequently, when examining a child, we used two series of tasks. Each of them included 5 tasks of varying degrees of complexity that were offered to a child according to certain rules.

The diagnostic examination procedure implies several important procedures, i.e., the observation of certain requirements for the presentation of tasks, the choice of ways to induce a child if he/she does

not want to cooperate with an adult, the use of fixed types of assistance when a child cannot complete the task independently, although he/she willingly meets a teacher. The evaluation of assignments emerges according to four criteria, which are as follows: the acceptance of the assignment, the degree of independence in its implementation, the attitude to the process and the result of the activity, the compliance of the result of the activity with the specified pattern. During special studies, we managed to identify four levels of constructive activities of hearing-impaired children i.e., compliance with the age norm, advancing of the age norm, lagging behind the age norm, and significant lagging behind the age norm. We summarized and systematized the data for each level of development in relation to the selected assessment criteria. The level of development of the constructive activity of children, who perform all the basic tasks independently, and cope with additional tasks above the age requirements independently and with the help of an adult (at least 4 tasks) is estimated as *ahead of the age norm*. The level of development of constructive activities of children is assessed as *meeting the age norm*, if they cope with the main tasks independently and with a teacher's help (at least four tasks are performed) and most of the additional tasks above the age requirements are not available for them or are performed with the help of an adult. If a child does not perform most of the basic tasks even with the help of an adult, but independently and with help deals with additional tasks below the age requirements, the level of his/her constructive activity is estimated as *lagging behind the age norm*. If both basic and additional tasks below the age requirements are inaccessible to a child even with an adult's help, the level of his/her constructive activity is estimated as *a significant lagging behind the age norm*.

We made a video collection of the necessary set of children's cases to create a sample of virtual practice. Each child is represented in the video during the complete process of his/her qualification examination.

Following the set of the developed principles, we determined the minimum required set of children's cases, i.e., 24. The age range of children was from 2 to 3 years. The range of differences in the state of the hearing was varying from sensorineural hearing loss of II degree to deafness. The range of options for the development of hearing-impaired children was from ahead of the age norm to lagging behind the age norm. In the videos, the children were using different means of sound amplification: hearing aids and cochlear implants.

We also formulated teaching requirements for the video filming of the process of examining children's constructive activities. Each child was filmed from the distance of 2-2.5 m. Firstly, we decided to provide a teacher and a child with comfortable working conditions. The specified distance was optimal for providing a student with the opportunity to see the teacher of the deaf and the child on the screen while working and to consider in detail their actions with the construction material. We mainly used the contrasting color background of the surface of the table and the details of the building material for the convenience of perception.

We had been selecting the children for four years. We selected, examined and recorded the children in several educational institutions. We selected the video clips that were necessary for professional exercises of a certain type and were used as stimulus material.

During the study, we developed a scenario of an experimental practice sample, including the description of certain aspects, which were as follows: program structure, students' activities, types of proposed exercises, stimulus material, ways to monitor the correctness of the process and result of each exercise, ways to assist in the exercise process, ways of final control of students' achievements. The developed scenario of the experimental sample of virtual practice and the created video collection were transferred to a programmer to perform the software implementation of the learning technology.

The structure of virtual practice includes four interrelated blocks of exercises that are performed sequentially:

Block 1. We learn to present tasks

Block 2. We learn to analyze the behavior of a child during an examination

2.1. Accepting assignment

2.2. The degree of independence of a child when performing a task

2.3. Interest in the process and outcome

2.4. Correspondence of the result of activity to a given sample

Block 3. We learn to make a conclusion about the variant of a child's development based on the collected data

Block 4. Control tasks

For the educational blocks of the program, we chose the following main types of productive activities:

- analysis of the task presentation correctness to a hearing-impaired child during the examination;
- comparison of the reference and erroneous behavior of teachers of the deaf while presenting tasks to a child, his/her compliance with the requirements of the methodology;
- Analysis of the implementation process, the behavior of children in the performance of each diagnostic task according to the criteria specified by the methodology;
- Analysis of the result of children's performing each diagnostic task;
- Synthesis of data obtained during the examination;
- hypothesis of a child's developmental variant based on the data obtained;
- analysis of additional data, their integration and synthesis for testing the hypothesis;
- Identification of a child's development options based on the totality of data obtained.

These student activities served as the basis for designing a system of consistently increasing in difficulty exercises in professional activity.

4 Discussion

In the approbation of the developed sample of virtual practice, 28 third-year students of teachers' of the deaf program of Omsk State Teachers' Training University took part.

In the process of organizing the experiment, we singled out several stages.

Firstly, the author of the diagnostic methodology for assessing the overall development of a young hearing-impaired child gave a course of lectures entitled "Psychological and pedagogical diagnostics of hearing-impaired children". For a detailed acquaintance with this methodology, we used the videotapes of examining hearing-impaired children with different developmental variants. We also demonstrated the differences in children's behavior during the examination. When conducting classes, we conducted a virtual practice with the students.

After the course of lectures, a control test of the students' readiness to apply the theoretical knowledge of the diagnostic methodology to practical work with a child was conducted. We asked the students to analyze the video recording of construction activities of two children, i.e., a child with a lagging behind his/her age norm and a child whose development corresponded to his/her age. The students were required to perform the part of their professional work, i.e., to evaluate the behavior of children during the examination according to the criteria given by the methodology, to record the data

in the protocol, to put forward a hypothesis and draw a conclusion about the development variant of each child's construction activity.

The analysis of the data showed that after the theoretical training, all students of the deafness education department (100%) turned out to be unprepared for the professional analysis of the behavior of children according to all criteria set by the methodology. No student could analyze the behavior of the children presented without mistakes (the percentage of errors ranged from 43% to 23%) even though the teacher had previously used video illustrations of the process of diagnosing hearing-impaired children of an early age using the same method being studied. The students experienced the greatest difficulties in analyzing the behavior of a child whose development was lagging behind the age norm. Analyzing the child's behavior according to individual criteria (the acceptance of the task, the degree of independence, the interest in the process and the result, the compliance of the result with a given pattern), the students, as a rule, underestimated children's capabilities.

However, in the ability to make a conclusion about the variant of the development of constructive activity, the participants in the experiment were divided into two groups. 57% of students were able to correctly identify options for the development of constructive activities of the two children. 43% of the students made the correct conclusion about the child, whose level of constructive activity corresponded to the age norm, but they were wrong in determining the variant of the development of the child who lagged the age norm, overstating his/her real possibilities.

The data obtained indicate the need for additional work on the formation of students' readiness to apply the studied method. All 28 students were offered a virtual practice developed by us. Before the start of work, we conducted a special seminar, the subject of which was the mastering of the program interface. Further, during the independent work, the students were given the opportunity to have a virtual practice, provided with a comprehensive help system. Each student was trained in professional skills necessary for the pedagogical examination of children, using specially selected 24 children's cases. The total duration of each participant's performance in the experiment with the exercises of virtual practice was 8 hours. During the work, each student could receive additional advice from the teacher of the course, who was the author of the diagnostic methodology and who controlled the virtual practice of its development.

After completing all the virtual practice exercises, we developed a control test. Each student was asked to analyze the video recording of the examination of hearing-impaired children with different developmental options: the advancing of the age norm, the matching to the age norm and the lagging behind the age norm (2 children). The videos of these children were not shown either during the lecture course or during the independent work of students with virtual practices. We asked the students to evaluate the behavior of children during the examination according to the criteria specified by the methodology, to record the data in the protocol, to put forward a hypothesis and make a conclusion about the development variant of each child's constructive activity. The students carried out all test tasks independently, the possibility of assistance was excluded.

Consequently, we analyzed each student's dynamics of changes in the assessment of children's behavior during the examination (reduction of the number of errors) and in determining the options for the development of the constructive activity of children.

The analysis of the obtained data revealed the positive influence of the created virtual practice. It resulted in a better skill to apply the diagnostic method and the readiness to use it in work with a child. Each student showed a tendency to significantly reduce the number of errors in analyzing the behavior of a child after the virtual practice. This fact proves the overall effectiveness of the practice. After the lecture course, the percentage of students' mistakes in assessing the behavior of children ranged from 43 to 23%, while after the virtual practice, the number of errors among all students, who intend to become teachers of the deaf, decreased significantly and was 0-3%.

After the virtual practice, the number of students who were ready to draw the right conclusion about the options for developing the constructive activity of children increased. If after the lecture course, only 57% of students made the right conclusion about the development options for all children, after performing the virtual practice exercises the number of successful students amounted to 86%. At the same time, 14% of students were still mistaken in determining the development options for the child who was lagging behind the age norm, overestimating his/her real possibilities.

According to the examination results, 100% of students positively described the user interface of the program. 92% of the participants in the experiment considered the use of virtual practice useful and necessary, describing its advantages. Among the advantages of the virtual practice, students noted the following features: the opportunity to analyze the examination of many "real" children with different developmental options, to gain independent practical experience in analyzing the behavior of 24

children; the possibility of multiple viewing of video recordings of a child's examination, returning to the analysis of difficult cases to understand the moments of a child's behavior, the lack of fear of making mistakes, the opportunity to independently use help at any stage of the virtual practice.

Consequently, the experiment confirmed the hypothesis of the study. After using the virtual professional practices, the quality of professional competence of the students of the teachers of the deaf department improved in the field of diagnostic activities.

The developed virtual practice can be used as a tool for assessing the degree of readiness of a student of teachers' of the deaf department to apply the diagnostics methods being studied in the practice of working with a hearing-impaired child.

The created approach and the general principles of design can be fruitfully used in the development of virtual practices for mastering a group of special techniques of multidimensional examination of children with impaired hearing in a wide range of ages.

5 Conclusions

One of the major findings of the study is the approach to the design of virtual practices for students of the teachers' of the deaf department, which serves as an example of designing a virtual practice of a certain type. It helped to master the methods of pedagogical examination of young children with impaired hearing to determine their development options.

The virtual practice of this type is comprehended in the system of mastering special diagnostic methods as a stage preceding the actual practice of working with hearing-impaired children.

Another important finding is the fact that the virtual practice of this type involves certain components of the professional activity of a teacher of the deaf, i.e., the analysis of a child's behavior during the examination according to the criteria specified by the methodology, the analysis of the behavior of a teacher of the deaf according to the specified requirements for the actions, fixing, analyzing and summarizing the data according to the specified requirements, forming hypotheses and logical conclusions according to the diagnostic technique.

The general principles of designing virtual practice aimed at mastering of a specific diagnostic technique have been defined. We have designed a pilot model of a virtual practice to master the methods of examining hearing-impaired children to identify their development options. The experimental verification of the created sample of the virtual practice has been conducted.

We have proved a fundamental increase in the effectiveness of the formation of professional competences of the students in the field of diagnosing the development of children with hearing impairments. It is critical to use the virtual practice of this type.

The proposed approach to the design of virtual practices for the development of private diagnostic techniques opens the prospect of creating virtual professional practices of this type in other areas of training for teachers of the deaf and special needs experts of other profiles.

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