Commercially Available Diagnostic Device Use in Educational Process: Experience and Innovation

Magamed Nasib Ogly Samedov, Gennady Sergeevich Aikashev, Irina Igorevna Ushatikova and Alexander Vladimirovich Minkin

Elabuga Institute of Kazan Federal University, Russia, Tatarstan, 423600, Elabuga, Kazanskaya Street, 89, Russia.

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The publication material discloses the use of the methodology of psychopedagogical diagnostics in working with children and students of different age groups, organized under the leadership of the school psychologist, social educator, school or university teacher or students in Elabuga educational institutions of the Republic of Tatarstan. Here an analysis of the experience of the diagnostic and commercially available device use by the teachers and students of Elabuga Institute of Kazan Federal University (EI KFU) is described, in particular: “Activation meter - AC-9k”, “Comfort LOGO”, “Personality factor questionnaire (diagnosis of personality traits according to the procedure designed by P. Cattell)”. Particular attention is paid to the organization of work with children in the mode of “a fairy-tale therapy”:- “Lord of Wonderland”; “Island of Childhood” and some other activities. A technology of modified diagnostic children’s games (children’s game kits) development is proposed as an innovative direction in commercially available diagnostic device use in school and university educational work. The article describes ways to design children’s game kits, the techniques and methodology of their use in working with students in schools, additional educational institutions, as well as in the classroom at the children’s camp “Intel Summer” and teenage associations “Junior Programmer” and “Young Physicist”. According to the authors, the development of commercially available diagnostic children’s game kits, as well as their use contribute to professional and creative development of all the members of educational process.

Key words: Diagnostics, Diagnostic equipment, Gaming technology, Educational institutions; Training of future teachers, Consolidation of school and university knowledge in academic, Creative, Technical and game activities.

It is known that the leading field of the teacher’s activity is the work on students’ mastering the subject knowledge, which fundamentally should be based on psychopedagogical and social diagnosis. In this connection diagnosing mental status, character traits and personality traits, cognitive assessment and analytical skills are forecasting pupils’ learning success are becoming the decisive factors in the educational process in all educational institutions. Therefore, one of the major directions of the work is diagnosing students’ interpersonal relationships, as well as various forms of their interaction with the teaching staff, parents and other students aiming to build practical knowledge, to develop communication skills in cooperation with other people. In addition, this work aims to provide various types of assistance to children in crisis situations (prevention of suicide, aggressive intentions, when experiencing grief or depression).
Another teachers' activity area is related to the prevention of students' pedagogical neglect, the study of the children's personality characteristics and child-rearing in the school and family being the basis of such preventive work. All kinds of lessons on the basics of correctional activities with both difficult and gifted children, as well as work on the students' professional orientation should have the same direction.

A similar approach is observed in a number of works by foreign authors whose activity is based on humane approach to the pupil, no matter what school he is learning at, and which gives high priority to the diagnosis of mental, psychological and pedagogical as well as social development.

Methodology

To solve the above problems, as well as upbringing and education of students and young people and issues related to them, various types of diagnostic equipment are now widely used. Currently, there are several areas of their implementation on the methodological, theoretical and practical levels:

These include, for example, the diagnostic device of hardware-software complex “Activation meter - AC-9k” (and its earlier versions), which allows diagnosing and, in some cases, developing the most important quality of the human basic structure levels: somatic, psycho-physiological, mental status and personality traits. Besides, the diagnostic tool “AC-9k” successfully operates automatically on the basis of the dialogue with the computer and gives conclusive diagnostic data of the tested students, which creates possibilities for their wide use in a number of Kazan and other universities of our country.

The essence of the device activity, according to the designers, is based on the fact that the signals from the sensors included in the device pass through the analog-digital converter and get to the operational system “Windows”. The device itself includes a number of diagnostic services, such as:

a) Eye estimation device; kinetic meter; coordination meter; activation meter; device for “Tapping – test” techniques; device for recording the critical frequency of light flashes;

b) Lie detector; universal diagnostic scale; device for acupuncture diagnosis and correction; device for diagnostics of the temperature of biologically active points (BAP);

c) Device for testing and individual selection of organic and inorganic substances in accordance with R. Voll method;

d) Device for diagnosis and formation of reliability under extreme situations, as well as a device for diagnosing and correcting the tempo feeling in the human body.

Work on “Activation meter” for human system diagnostics and the development of human mental functions are described in the work by Y.A. Tsagarelli, who is a leading specialist and developer of the aforementioned devices. His manual contains a large bibliography of domestic and foreign literature (including the author's own work) that significantly expands the theoretical and methodological basis of high school teachers' research work in this area [3, pp 245-419].

Not less interesting are software devices of the computer system “Comfort LOGO” equipped with biofeedback (BFB). It can help the tested person to master the mental state regulation skills. In addition, by means of such devices as “MIKART” and “USO – 01” (Unified Service Equipment), included in “Comfort LOGO”, one can register a set of physiological parameters of the human body, which provide the tested student with real-time information of his condition. Computer system “Comfort LOGO” software also has a user’s interface which is simple and intuitive, as well as a varied range of “multimedia” capabilities of modern computer technology. In addition to training sessions, the program has a “diagnostic mode that allows you to record and analyze the human condition that changes from session to session (the so-called index progress)” [4, p. 5].

As practice shows, “Comfort LOGO” allows to make, first, the two types of testing and organize diagnostic session to identify the level of muscle tension; second, to identify some evidence of cardiac activity (“Cardio”) and respiration (the ratio of the chest volume from the time and the number of breaths per minute); third, to register the peripheral temperature and its dependence on time, and to use multimedia resources to organize training (correctional) sessions in music, slideshows, video, voice recording and a session...
of “Colour Preference” which is a modification of diagnostic techniques “Color Selection” by M. Lüscher that may involve children aged 4 and older ones.

In addition to these instruments, teachers of Elabuga Institute of KFU working with schoolchildren and students widely use devices for diagnosing “personality traits by R. Cattell”; method devised by A.B. Leonova (integrated diagnosis and correction of occupational stress), as well as other commercially available devices and diagnostic techniques.

Practice shows that when organizing activities with children and adolescents (from 4 to 11-14 years old) diagnostic techniques developed by the scientists-practitioners of St. Petersburg, led by T. Zinovich - Evstigneeva, D. Kudzilova and N. Danilova for developing psychological games technology deserve special attention. They include paper building kits, such as “Lord of Miracles”, “Island of Childhood” issued by LLC Publishing House “Rech” and some other devices for playing games.

This technology in the mode of “a fairy-tale therapy” is a complex of board travel games. Playing which children under the guidance of their adult mentors performs creative tasks of different difficulty levels (in groups of 2 to 9), depending on their age and individual characteristics. These games include: playing field with a different number of tasks and rules of the game, chips, dice and handout materials with fabulous and fictional characters. They also include a detailed guidance, the description of game and life situations, prizes and other materials.

It is known that in addition to paper versions, today, there are many electronic and interactive games of various content and quality that after a detailed examination could be recommended to children of different age groups to organize their leisure and entertainment, among them: “Learned Cat”, “Wise Owl”, “Animated Cartoon Shop with Smeshariks (Funny Balls)”, “Driving Skills (full course)”, and some others.

However, in our opinion, their use as only didactic or educational games prevents the teacher-researcher from seeing the totality of possibilities that “gadgets” and technological innovations of the modern development of game industry (including combined design game kits) can provide. However, these will require, in turn, not only a more detailed theoretical description, but also the development of methodological basis for their implementation in school or university laboratories.

Firstly, as KFU Elabuga Institute experience shows, game diagnostics application to work with children of different age groups leads only to positive results. In particular, preschoolers’ motivation and an interest in the upcoming classes in their institutions and schools are significantly increased. The students’ knowledge of school subjects and that which is gained in extracurricular classes is activated and becomes more profound; conditions are created for the formation of children’s values in life and their emotional development, communication culture, creative imagination and speech.

Secondly, the use of game technology in the diagnostic work with children, as our many years of experience prove, never causes psychological rejection on behalf of the children of different age groups and categories, as well as their close relatives, especially parents, older brothers or sisters, and their teachers and educators.

A diagnostic technique innovative direction (which is by the way less time, material and financial resource consuming), in our opinion, could include the development and implementation in the educational process of diagnostic game kits and homemade building kits. We started such work in mid 90’s of the 20th century in a school research laboratory of the creative association “Scythians” and are continuing it at present. Over the years we have created such devices as “Bio Energy Meter”, “Matrix of Success”, “Funny Frogs”, “Yin – Yang” and “Lucky Chance”, which in our opinion requires a special or at least individual explanation.

Output

Catching a solution of the problem what can inspire modern children and young people in education and after school activities we turned to the history of design, development and application of game kits, which soon convinced us that they have a huge research, technical and creative potential, not only for children, but also for the teachers.

1. In the course of many years of research (2011-2014) in which senior students,
educators from preschools, primary school teachers and other categories of adult population participated, we found a surprising pattern. Out of the 350 participants in the written survey, 343 people expressed their positive attitude towards the implementation of the game diagnostic techniques in the work with children and adolescents, which amounted to 98%. It should be noted that only 7 people (2%), expressed some doubts on their implementation in the educational process of modern Russian education.

2. It should be noted that the technical stuffing of such devices can be extremely diverse. In our experience in particular it includes “a detector of concealed wiring”; micro ammeter with a 100 - point scale; copper and galvanized plate; clock and stopwatch, compass, temperature and humidity sensors, as well as other technical safe-at-home devices with their construction quality certificates. In addition, its components may include switches, LED bulbs, elements of chargers working on solar or electric batteries.

3. Game stuffing of the kit must also be very diverse. It includes various elements of volume or flat toys, parts or entire complexes of electrified music games and entertainment of domestic or foreign production, and etc.

Collected in a single design portable suitcase with a detailed technical, methodological and technological support, all this stuff gets a new quality. It becomes a diagnostic tool, which can find human obvious or hidden potential, whether the tested is a young child, or an elementary or high school student, or even a university student.

Here it is appropriate, in our view, to give a more detailed description and a brief history of one of the above named diagnostic game building kits, which is named “Funny Frogs” taking into account that its creation was preceded, in general, by a random purchase of an individual touch screen electronic game “BRAIN TRAINER” designed by the international community “MENSA”.

Taking into consideration that “MENSA” is an international community of people with a high IQ of 40 countries, whose number exceeds 100,000 people, we got interested in their technology. It was attractive for us that each of the participants could choose any of its nine tests, as well as the number of tests and their sequence, the run-time limit, the three-level complexity degree of each task, with elements of mathematical processing, for example, a percentage of correct execution (which is done automatically by the toy device). A decisive factor, however, was that each participant had an opportunity to run the game on the touch screen with a special “pen”.

DISCUSSION

Unfortunately, the game as it can be understood from its brief description is solely of an individual character, which is true in reference to many modern electronic games of foreign production, and it fits a younger teenager’s hand. Moreover, the small touch screen makes it unattractive for diagnostic purposes.

That was why we decided to improve the technology of the game itself, without sacrificing the integrity and copyright of its developers, making it more attractive for children of different age groups and even adults, for example, university students as the most active participants of our projects “Games of our Childhood” and “Instructive Methodical Session (IMS)”. Pupils and students could participate in various competitions in our projects, such as the most inquisitive, intellectually gifted and creative personality, both individually and as part of a small group consisting of 2-3 participants or a team of 4 to 9 people.

Simultaneously with the construction of the diagnostic game we made a rather detailed description of the whole complex of the device actions, and named it “Funny Frogs”. We paid attention to the rules for the participants and organizers, highlighting the success levels of the tested at various stages of the game and various levels of complexity. This approach significantly expanded the diagnostic capabilities of the game, which allowed us to use it successfully at our meetings with children in the city schools, the children’s camp “Intel Summer”, in the children’s associations at the Department of Physics and Technical Disciplines and Information Technology, as well as in the Children’s Creativity Center in
Elabuga.

As we anticipated the diagnostic game “Funny Frogs” aroused not only school children’s, but also university students’ interest, especially while studying such disciplines as “Social Pedagogy”, “Education Theory and Technology”, “Modern Means to Evaluate Learning Outcomes” and “Workshop on Physics and Computer Science”. This was also confirmed by another mass survey, in which over 380 people participated, including children as well. The majority (99.6%) of the respondents showed a positive attitude to these kinds of kits, as well as to the development of commercially available game diagnostic technologies.

However, this, in turn, requires a more detailed development of the technology for socio-pedagogical support of children’s diagnostic games in education.

Above all, as it was mentioned above, the main content of the game diagnostics includes a “Mind Simulator” which helps to identify certain personality traits of the participants. All these personal qualities can roughly be divided into socio-educational and psycho-educational modules.

Test Module 1 (game # 1) aims to identify mathematical abilities; Module 2 “Consistency” aims to determine the amount of short-term memory; and Game # 3 “Do not peep” aims to develop imaginative memory.

Module tasks (game tests # 4, # 5 and # 6) help to determine analytical, forecasting and creative abilities of the tested students (for example, correctness of direction), and # 7, # 8 and # 9 help to determine pupils’ or students’ constructive abilities, level of academic achievements and projective qualities [8].

Moreover, at the end of the game each of the participants (as well as the entire creative team of “green” or “red and yellow frogs”) can get a detailed description of the results of his/ their express-testing according to score or rating scale, especially developed for these purposes.

As our observations show, all participants of the express-diagnostics (not including tests) show particular interest in minor games “built” in the briefcase. These include “musical hearts”, electronic lights, a “windmill” in the shape of a frog, etc. Their purpose is not only to attract the participants’ attention, but also, if necessary, to complicate the nature of diagnostic procedures, taking into account the age of the tested students and their level of education, which is a powerful incentive for the development and creation of new game diagnostic technologies.

It is important to note that as practice shows, modern school, the more so provincial, is still far from diagnosing intellectual and creative potential of the child by using devices such as engineered by us. Even the rare tests, for example, determining the reaction rate or the propensity to a certain type of occupation using computer programs are not accompanied by well-organized reflection on the results. Students fill in all sorts of checklists, questionnaires, tests, which are quite common forms of diagnosis in school. But usually students passing such an examination are not aware of the results nor do they receive any feedback.

Although some findings are announced at the parents’ meetings, most often it occurs after a large gap in time, and students learn this information from their parents. Therefore students often fill in questionnaires and other kinds of diagnostic forms rather carelessly.

One cannot but mention the fact that some teenagers in order to learn themselves take the on-line testing. However, the theme and the quality of many tests available on the Internet, often cause doubts among professional psychologists, teachers and educators. As a rule, the results rarely exert constructive influence on children, their self-knowledge and self-development. As for parents and teachers, they do not get such information at all. In addition, analysis of the adolescents’ choice of computer games shows that they are primarily of entertaining character rather than educating or developing.

Thus, in our view, the targeted use by psychologists and teachers of various kinds of automated tools will help to optimize the psychological and educational assessment in an educational institution.

The advantages that allow including devices designed by us into the educational process as a means of diagnosis and development of the child, in our opinion, are:

a) The relative simplicity and availability of using the diagnostic kit by both the teacher
and the child from an early age;

b) Its versatility, i.e. possibility to use the kit both for development and assessment of intellectual and creative potential, personal qualities, regulation of behavior, relationships with other children, teachers, parents, mental development, coordination, etc;

c) Every child or a group of students can choose the most attractive at a particular time diagnostic kit, techniques or technology diagnostic procedures from a variety offered;

d) The possibility of returning to perform operations on the child’s own initiative and using the kit as a training device;

e) The minimal time restrictions for the child’s attempts in learning to use the device properly;

f) The child’s or the group of children’s prompt receipt of the visual information and feedback from the teacher on their achievements;

g) Visual appeal and the equipment of the device with unobtrusive light and sound signals;

h) The children, especially teenagers, can be attracted to the manufacture and design of diagnostic devices on the basis of various electronic toys and household devices (a clock, a thermometer, etc.);

i) Environmentally friendly materials which are used to produce diagnostic kits, as well as the ability to handle the work surface in accordance with the hygiene requirements of modern society and a number of other fundamental qualities.

Among the main conditions that promote a more efficient use of the device as a means of diagnosis and development of the child and other categories of the population we can identify:

a) The teacher’s ability to have a systemic vision of educational reality;

b) The teacher’s ability to create a relaxed atmosphere and to use predominantly non-obligatory (humanistic) style of interaction with children, creating a situation of success;

c) The teacher if necessary can participate in the implementation of some particularly complex jobs offered to children;

d) The teacher’s purposeful observation of the child’s actions, emotional state, the reaction of the child in selecting and performing the tasks;

e) The teacher’s speech has a reflexive content and the teacher is able to organize the child’s reflection activities;

f) The correct interpretation of both the proceedings and results of the test;

g) Organization of individual, group and mass forms of diagnostics in the format of the game, competition, contest among curious guys, designing skills development, research knowledge and skills;

h) Prompt clarification to every child of the results of his activities and formulation of recommendations in the form of advice, suggestions, or a friendly instruction.

CONCLUSION

The analysis of psychological, pedagogical and technical literature indicates that the game kit (as well as its other above-mentioned modifications) is of the design system “motivation meter”. This is, in our opinion, a name to all diagnostic instruments for measuring motivation level, mental, psychological and social human personality traits – those areas where the teachers’ work includes the organization of game express-testing.

According to national and foreign experts the main goal of such investigations is to help the tested people to understand themselves and other people, the world and society as a whole. This is where a closer relationship and interdependence of technical, technological, social and scientific provision of training and educational process is implemented.

Moreover, a retrospective analysis of domestic periodicals shows that the whole system of public interest principles (humane treatment of personality, interest development, voluntary participation, etc.) is not only declared here but implemented in practice; and psycho-pedagogical, social and diagnostic work with children, adolescents and young adults is carried on.

As our experience shows, participants to diagnostic games especially appreciate the ability
to win a musical prize that can be a melody or a song chosen “on color keys or hearts”, and the game kit’s “exclamation”, such as for example, “I love you!”

The main thing is the fact that the system of human values “motif - incentive - result - reward” is implemented. A motivation, incentive and reward for the child is an approval and praise for taking part in the game, the satisfaction of his natural curiosity, his senior’s imitation (e.g., teacher), and etc. Particularly valuable, in our opinion, are the situations where the organization of diagnostic work enriches the experience of all the children, develops their habits of cooperation with other people and arouses an interest in their own personalities, in social personality traits, which can be looked upon as the result of the entire innovation process, and not only as a sphere of game activities.

On the basis of long-term observations of creation and functioning of diagnostic game kits, we came to the conclusion that most of them can provide information about one or two, maximum three psycho-physiological, educational or social qualities of the individual child or a group of children, or school children within a certain period of time. We also saw that in the course of the contest, competition or any other educational activities with the use of game design kits the diagnostic information received by the teacher is creative, and it promotes all participants’ self-development and self-teaching. In addition, we believe that neither commercially available nor game diagnostic kit can be multi-functional (likewise medical devices), even if it is provided with a computer of a sufficient volume or software. All this gives us hope to create in the near future (or prospect) a whole line of technical game kits of various diagnostic kind on an industrial basis.

It is natural that the teacher-researcher closely watches the students’ actions in all activities accompanying the process of designing and every child’s participation in the express-diagnostics making special entries in a notebook or journal. With the parents’ and children’s consent, the whole process of diagnostic games can be shot on video, cell phone, web-camera (which Russian children are very fond of), or some other equipment, for later viewing or further studies. According to the information received on the children’s interest in the games and their results teachers can arrange a variety of interviews, additional classes, oral and written surveys beginning with preschool age, which allows making a detailed analysis of the work (reflection), making diagnostic tables, pie and bar charts, encouraging the most active participants and their assistants.

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