

## Pedagogical System of Students' Vocational Ability Development

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### ABSTRACT

The purpose of this study was to examine science teachers' level of using computers in teaching and the impact of a teacher professional development program (TPDP) on their views regarding utilizing computers in science education. Forty-three in-service science teachers from different regions of Turkey attended a 5 day TPDP. The TPDP was structured in modules designed using inquiry-based interactive computer simulations (IBICS). The participants created modules on different science subjects during the TPDP. Their progression was evaluated by micro-teaching sessions. Mixed methods research was used. The data were gathered by a survey and semi-structured interviews. Findings indicate that most of the science teachers initially lacked the necessary skills and knowledge for using computers in teaching. However, after the TPDP majority of them developed positive views on using computers in teaching and learning. Also, for teachers the TPDP provided ways and methods of successful integration of ICTs in teaching.

### KEYWORDS

Maximum training individualization, development of potential, pedagogic concept, vocational ability, students' vocational ability

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## Introduction

One of the most important resources of society is its intellectual capacity. Experience and success of the most developed countries in the sphere of science, production, new technologies development, culture and education indicate the need for a radical restructuring of the education system in order to create the conditions for talented youth to show its nature and to develop according to its skills.

The Republic of Kazakhstan has developed a state program for search, support and development of talented children and youth. The objectives of this program are:

1) Strategy determination for training and education of talented children and youth;

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2) Development of intellectual potential in the Republic;

3) Providing of talented young people with socio-cultural development (The concept of identification, support and development of talented children in the Republic of Kazakhstan, 1999).

This issue is relevant since there is no consistent concept of talented individuals development covering all age limits, and no complete studies of "students' vocational ability".

### Literature review

The Republic of Kazakhstan pays considerable attention to the study of students' professional training problems in universities:

1) Tendencies to the development of higher education, reflecting patterns and new approaches to the organization of higher education: K. S. Musin (2000), T. S. Sadykov (2005), etc.;

2) Psycho-pedagogical and didactic bases of higher school, representing the learning principles and personality formation of future specialist: A. E. Abylkasymova (2000);

3) Learning technology improvement in higher education: B. A. Abdykarimov (2006).

Studies of the above-mentioned professionals have become the foundation for our paper: they describe human potential as a social development criterion, present the theory and practice unity in higher education, analyze the features of credit system implementation in educational process.

The following scientists have presented the identity formation analysis of modern teacher in their theoretical insights: T.G. Khairullin (2005), V.D. Simonenko (2006), S.A. Uzakbaeva & K. Kozhakhmetova (1997), J. Li (2016), F. Kaya (2015) and G.I. Gaysina (2015). Their researches reveal different aspects of pedagogical education, describe the structure of educational activities, characterize the competency of future teachers and provide ways to improve pedagogical education.

Of particular interest are the studies of psychologists and teachers devoted to the pedagogical talent formation (Kuzmina, 1985), pedagogical abilities development (Aminov, 1997), intellectual development of students (Rezakov, 2002), creative potential formation in future specialists (Altynay, 2015).

The following researches are dedicated to the methodological patterns of educational process taking into account students' personal characteristics: learning process individualization (Li, He & Li, 2015), educational differentiation (Viunova, 1999), person-based approach (Vikulina, 2001).

The scientific works analysis in the context of higher education indicates the existence of a theoretical and methodological basis of our study; however, studies dedicated to the professional development of talented students have not been found. The methodological aspects of work with talented students are missing as well.

The psychological and pedagogical literature analysis (Mayer, Caruso & Salovey, 1999; Sternberg, 2002; Trost, 1999; Gardner, 1998; Popescu-Mitroi, Todorescu, Greculescu, 2015) on the talent study shows that, despite the multitude of scientific approaches, the study of talent includes four areas:

- 1) the relationship of general and special abilities;
- 2) intellectual talent development;
- 3) creative talent development;
- 4) the study of talent as a holistic personality (includes intelligence, creativity and other noncognitive components).

Thus, the new trends in the international community formed the problem of talented children and youth development as one of the priority task for modern pedagogy. Most researches are focused on the study of children's talent. Current concepts of children's giftedness cannot be applied to students in the context of higher education.

### ***Aim of the study***

To develop a theoretical and methodological approach and pedagogical conditions in order to organize professional development of talented students in universities.

### ***Research question***

What subjective and objective factors affect the talented student development?

### ***Research methods***

The study took place in three phases:

#### ***First phase (2001-2002)***

The problem in local and foreign higher schools was studied; the philosophical, sociological, psychological and pedagogical literature was analyzed; the theoretical and methodological approaches to the problem solution were determined; theoretical principles and conceptual approach to the solution of research tasks were grounded; the conceptual framework of the study was defined; the theoretical model of students' vocational ability was developed; the characteristic of the future teacher vocational ability was given as well as the criteria, indicators and levels of development; the problem of abilities and talent diagnostics in high school was studied; a diagnostic algorithm was developed and diagnostic material for the study was selected; a further study program was determined.

#### ***Second phase (2002-2003)***

The examination was conducted in order to explore the talent development levels in students of pedagogical University (Abai Kazakh National Pedagogical University); the obtained data analysis was performed; the university documentation analysis was carried out (State Educational Standard; the curriculum; steering documents; study letters; learning and methodological material in pedagogical disciplines); potential possibilities of pedagogical process improvement were identified with the view of vocational ability development; pedagogical conditions were identified in order to organize the process of talent development; pedagogical system of talented students' vocational ability was designed; a comprehensive program for training and development of professional talent was developed; the content of further experimental work was determined.

### ***Third phase (2003-2008)***

An experiment was conducted in order to implement the educational system on the developed program basis; the interrelation of vocational ability development and professional training improvement was discovered; midterm and final tests were conducted; quantitative and qualitative results' processing and hypotheses test were carried out; conclusions and recommendations for lecturers were made; the concept introduction into universities work practice and new opportunities for the talented students' vocational ability were generalized.

### ***Research experimental basis***

Abai Kazakh National Pedagogical University (Almaty). There were 142 students of 1-2 years from 5 departments and 10 specialties taking part in the ascertaining experiment. Students studying in the specialty "Pedagogy and psychology" and a joint group of students from "Pedagogy and psychology" and "Pedagogy and elementary education methodology" departments were involved in the formative experiment.

### **Results**

Scientific novelty of research:

1. Justification of the conceptual and pedagogical approach for talented students' vocational ability development taking into account modern trends in higher education;
2. Introduction of the term "vocational ability" into scientific use as a dynamic and integrative quality of personality;
3. Development of the pedagogical system for talented student's professional development in a university.
4. The formation of pedagogical conditions, which provide effective vocational ability development of the student-educationist.

The structure of the vocational ability conceptual model includes the following factors:

1. Subjective factors:
  - Intellectual and creative potential as a universal talent basis, and a necessary condition for self-realization and self-expression in any sphere of professional activity;
  - Professional abilities as an essential factor of vocational ability in a specific activity area;
  - Motivation as an impelling force of development in achieving goals and getting high results;
  - Intelligence contributing to professional success, as a practical intellectual ability (in the unity of social, emotional, and practical intelligences) in the context of real interaction.

Professional talent is formed on two levels of the pedagogical process in a university:

- I. Based on the State Educational Standard unified requirements of higher vocational education.

II. On the basis of specially created pedagogical conditions with the view of students' vocational ability development at a particular institution.

## 2. Objective factors:

- Microenvironment: family; relatives; the university educational environment; lecturers; special conditions of training, development and education; fellow-students; the workforce, etc.;
- Mesic environment: social class; specific social situation; ethnic and cultural peculiarities of the region; cultural and educational level and type of settlement (city, village); geosphere living conditions; communication media, etc.;
- Macro-environment: socio-economic conditions in the society; the specific historical time in which a person lives; astrological factors of the birth etc.

These two groups of factors (subjective and objective), in our opinion, reflect the objective reality of the individual vocational ability and are the talent structure subsystems of the future specialist. The primary selection criterion for these two subsystems is the dependence between them. This means that different structural relationships exist both between the two subsystems (subjective and objective) and within each of them, i.e. between their components. In this case, the most important is the subjective subsystem, which is under the direct influence micro-environmental factors (in our case, these are the educational environment conditions in the university).

The vocational ability model is presented in the form of graphical diagram reflecting the described relationships between the subsystem and all its components (Figure 1).

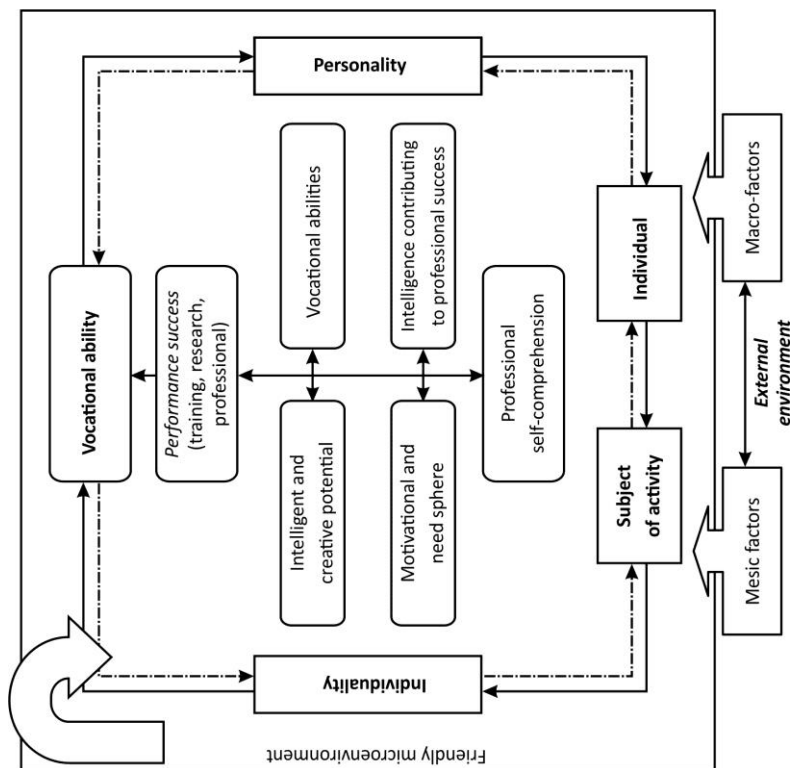


Figure 1. Vocational Ability Model

Based on the methodological principles and developed vocational ability model, we can define the notion of "vocational ability". Vocational ability is a dynamic integrative and personal education, characterized by the unity of individual, subjective and personal characteristics, in which the individual and professional experience reaches the highest degree of development and generalization, achieving success in a particular activity area.

Taking the interpretation of a concept "vocational ability" as a basis, we can characterize the notion of "students' vocational ability" as an integrative and personal education, characterized by a high-level development of general and professional abilities in conjunction with motivational and personal characteristics, enabling to achieve special success in educational and professional activities.

Process modeling of the students' vocational ability development in a university requires adequate practical implementation; this process implementation quality depends on the work of teachers and students' team, that is, the pedagogical conditions system that forms the basis for mastering the necessary skills.

We have identified three groups of pedagogical conditions, which together can ensure the implementation of the talent development process in a university: organizational-pedagogical, psychological-pedagogical and didactic.

The group of organizational-pedagogical conditions ensures the efficiency of the pedagogical complex interaction with talented students within the higher school. In this group, the following complex of pedagogical actions was included:

1. System staffing is the selection of the lecturers and undergraduates for the pedagogic system, i.e., special training of educators and undergraduates with the view of working with talented students based on the developed special course "Talented student: performance, training and development", special seminars, round tables, consultations, etc.;

2. The creation of talented students' psycho-pedagogical service (department) as the pedagogical system main control whose primary responsibilities are performance, forecasting, planning the "personality development individual path", implementation of special programs of training and development, etc.;

3. The realization of tutors' service, i.e. the service of individual consultants and mentors for students, who are going to help in developing an individual program of professional self-determination and development for talented students;

4. Training and methodological support is the training programs development for subject-matter disciplines, which will be described in a differentiated approach to teaching;

5. Diagnosis and regular monitoring of the vocational ability development level, which takes into account the level of normative educational minimum mastering, that is digestion of State Educational Standard programs for higher professional education;

6. Maximum individualization of talented students training and development to achieve the maximum level of program implementation, i.e. developing individual plans and programs for the training and development of each individual student;

7. Differentiation of training and development - creation of mini groups within a large homogeneous group, which are formed based on results of professional abilities and vocational ability formation, both during training and in extracurricular activities;

8. Active cooperation of educational and extracurricular student activities, where considerable attention is paid to the extra-curricular activities organization. Those activities reinforce the educational programs assimilation effect and provide financial support for talented students: increased scholarships, participation in scientific conferences, seminars, publication of scientific articles, participation in Olympiads, competitions, festivals, studying at foreign universities, etc.;

9. An integrated approach to learning and development management, that is focused on ensuring the unity of educational, scientific, research, professional and practical activities of students;

10. The flexibility and variability of teaching process, which involves the choice of specialty courses, content, forms and methods of education by the students themselves, taking into account their individual activities;

11. Teaching process modernization is the special training programs creation, educational materials preparation, study guides' development including tasks that take into account the difficulty levels variability;

12. The comprehensive approach to the learning process, which has the purpose of promoting the vocational ability development in various forms of activities such as teaching, research or professional activity;

13. The pedagogical interaction strengthening between lecturers and students, which is based on cooperation and joint creative activity.

14. Group research organization and conducting, the creation of the Young Researchers Council (YRC), Student Research Society (SRS), Student Scientific Circles (SSC), creative laboratories and scientific schools under departments and faculties, providing the academic interests' differentiation, thematic unity and scientific communication;

15. Providing the material and technical basis so that the students are free to use different information sources in the training process;

16. The solution to the talented students' employment problem after graduation that will allow them to feel the demand in the labor market and realize the possibilities for their further professional activities.

The group of psycho-pedagogical conditions determines the teaching and pedagogical activity nature helping the pair "lecturer-student" to cooperate. This interaction directly affects the talented students' vocational ability development. In this group, the following psychological and pedagogical features were included:

1. The students' motivation for the potential opportunities development in order to master the future profession skills;

2. Creating conditions to influence the students, which has the purpose of developing students' abilities both in training and in extracurricular activities;

3. Promoting the lecturers' and graduate students' activities to work with younger students according to the vocational abilities development system;

4. The determination of vocational ability level as a whole and its separate components at each stage of the students' engagement;

5. Learning motivation in order to form a professional self-comprehension and confidence among students in the importance of developing their abilities and intellectual and creative potential within the framework of university studies and professional activities in general;

6. Considering the peculiarities of mental processes' formation during the study and professional activity;

7. Lecturers' awareness and acceptance of each student individuality uniqueness and value; understanding of the subject-subject paradigm in higher education;

8. Using the collaboration and joint creation principles, the lecturer's vocational ability "broadcasting" based on dialogue interaction and intersubjective communication with the student;

9. Encouraging student's free statements on special problematic assignments. This pedagogical condition helps students to challenge existing views, to generate new ideas, organize and critically evaluate the results of their activities;

10. Encouraging students in order to ensure that they study the topics they choose within the elective courses. Pedagogical support and development of students' independent search work in the learning process – building skills to learn;

11. The creation of a continuous training and research, thematic unity of scientific and research work, which takes into account the scientific generations' continuity, the Scientific research work of students (SRWS) integration in educational disciplines, specialty courses and practice;

12. Promoting the implementation of students' research work results, public debate skills' formation and learning to defend their ideas and research results;

13. The formation of ability to develop self-knowledge, abilities, talent, potential awareness and individual differences' understanding;

14. The appropriate psychological climate creation during lessons: friendly attitude towards students, a joyful attitude to knowledge, positive emotions, creation of student's high self-esteem, feeling of success, self-confidence, compliance with the "right to make mistake" principle;

15. The results' analysis of individual creative activities (each student has a "portfolio" of achievements): students keep a journal of their own creative achievements, which takes into account the success dynamics for each individual student, without comparison with other students;

16. Timely diagnosis of the vocational ability development in general and its separate components, development trends identification with the view of predicting and designing future stages of the personality development;

17. Talented students' moral, psychological and financial stimulation and social support;

18. Individual psychological support for talented students: increased scholarships, recommendation for participation in the presidential program "Bolashak", attraction to work in scientific conferences, Olympiads, competitions



and festivals, recommendations for master's and doctoral programs entrance, the most talented are sent to study at the best foreign universities.

Group of didactic conditions includes ways, forms and methods of educational and cognitive activity development in students during studying at the university:

1. Orientation at the methods of talented students' vocational ability development is how they learn compulsory minimum of professional training program (State Educational Standard program for higher professional education);

2. Training and methodological support is the special programs' development for different educational subjects, the variability of educational services, implementation of individual development plans and programs, etc., which take into account the factors of students' educational and professional activity during the vocational ability development;

3. The organization principle is based on the holistic thinking functioning, which is inseparably linked with the convergent-divergent thinking type that allows people to discover and expand their possibilities when generating ideas, finding and creating a new product;

4. Research approach to conducting lectures, seminars and practical classes build upon problem-based learning, the use of heuristic methods in educational and creative organization for talented students;

5. Commitment to the work with global themes, which takes into account the students' scientific interest differentiation and focuses on the development of future professional activity;

6. The use of an interdisciplinary approach based on interdisciplinary integration of issues, topics and problems relative to different areas of subject knowledge;

7. During the topic studying process, the "open type" educational activities should be implemented. They allow taking into account the talented students' vocation to research and independent intellectual activity;

8. The use of active learning forms such as group discussions, brainstorming, role and business games, group and individual research projects, etc., which contain the optimal combination of frontal, group and individual work forms;

9. Teaching students critical evaluation of their activities according to specific substantive criteria that are associated with specific scientific area and future professional activity issues.

Along with these necessary general terms for the effective organization of the pedagogical system, each component of the system (diagnostic, educational, extra-curricular) with this category of students within higher education involves a set of necessary pedagogical conditions on three levels (psycho-pedagogical, didactic, organizational-pedagogical). These conditions comprise certain requirements for the effective implementation of each component in order to achieve the result – higher level of the future specialist's vocational ability.

## Discussion and Conclusions

Hence, the following conclusions can be made:

I. Professional talent is a complex integrative personal education: on the one hand, it is an integrative quality, on the other – the process and result of intellectual-creative activity of the student (educational, research and professional).

II. "Talent" and "vocational ability" are the interrelated and interdependent concepts, but not identical.

III. Professional talent is characterized by a specific structure, content, stages and levels of development, determining factors in terms of pre-university, university and postgraduate education.

IV. The structure of professional talent consists of 5 components: intellectual-creative potential of personality; professional skills; motivational and need sphere of personality; types of intellectual abilities that contribute to success in professional activities and life in general. The highest achievement of student's vocational ability development is an internal mechanism of development, manifested in professional self-comprehension. External criterion and a system-forming development factor is the success in the student's leading activities: academic, research, professional. The combination of all these components based on professional competence comprise professional competence of the future specialist. This model serves as the basis for the talented student development.

V. By virtue of state standardization and uniformity in the higher education system, two ways should be implemented when working with talented students in university:

1. On the one hand, it is important to provide a State Educational Standard for all students;

2. On the other hand, it is essential to provide maximum individualization of training for the most capable students and vocational ability development of future professionals through the appropriate educational environment creation.

VI. The creation of an adequate educational environment for the vocational ability development of talented personality in the university is possible only with systematic organization of work with this category of students.

An important aspect is the pedagogical training. E. Antonova (2010) believes that the pedagogical environment should include external factors such as the popularization of pedagogical practice when working with talented students; conferences and task allocation. At the same time, the author believes that a teaching system should include at least five aspects of work in this direction:

- 1) Special lecturers training in universities (as well as graduate students training) through a special course and a series of seminars, round tables, meetings, etc.;

- 2) Diagnosis that represents a long gradual process of 5 stages: pre-search; professional selection; differentiation according to levels of professional talent; remedial and developmental phase; student's self-assessment stage;

- 3) Training and vocational ability improvement on the basis of specially developed program that provides both collective and individual forms, methods and techniques of work with students and the implementation of individual development programs;

4) The additional educational services supply, which provide psychological, pedagogical, moral and social support for talented students at the university;

5) The need to cooperate with employers to ensure highly qualified personnel in this field of professional activity.

The relationship and interdependence of these system components is proved by the results of experimental work.

However, we agree with E. Antonova (2010) that psychological accompaniment of talented individuals should be created from preschool age to university. This is necessary to maintain a healthy and full development of the talented child.

### Implications and Recommendations

The research resulted in the development of a conceptual approach based on the continuous development of personal talent throughout human life. The research enabled expanding the subject field for future studies of a person's vocational ability, in particular, professional selection and entering colleges and universities, depending on specializations; theoretical and methodological aspects of developing future specialists' vocational ability, depending on the university specialization; applying information technologies in the work organization with talented students; remote and interactive education and development of future specialists' vocational ability, etc.

The problem, topic, theories and conclusions of the research provide a new statement and solution in the theory and practice of university:

- methodological bases of the conceptual and pedagogical approach to developing future specialists' vocational ability were substantiated, with regard to modern tendencies in universities;

- the "vocational ability" concept was introduced as a dynamic and integrative personal trait; the structural and conceptual characteristics of future pedagogues' vocational ability were developed;

- the model of the pedagogical system for developing future specialists' vocational ability in universities was developed;

- the set of pedagogical conditions that ensure efficient development of future specialists' vocational ability in higher pedagogical educational institutions was distinguished;

- methods of stage-by-stage diagnostics and monitoring of the future specialists' vocational ability development were implemented.

Theories, conclusions, recommendations and materials of the research, intended to provide educational and methodological support for the pedagogical system of future specialists' vocational ability development in universities, can be used in the educational practice of higher educational institutions of any specialization to organize work with talented students, to teach pedagogical disciplines, to train and retrain pedagogical staff. The comprehensive program for developing future pedagogues' vocational ability and the project of "talented student" concept were submitted to the Ministry of Education and Science of the Republic of Kazakhstan and the "Daryn" Republican Scientific and Practical Center for practical implementation at the national level.

### Disclosure statement

No potential interest conflict was reported by the authors.

## Notes on contributors

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