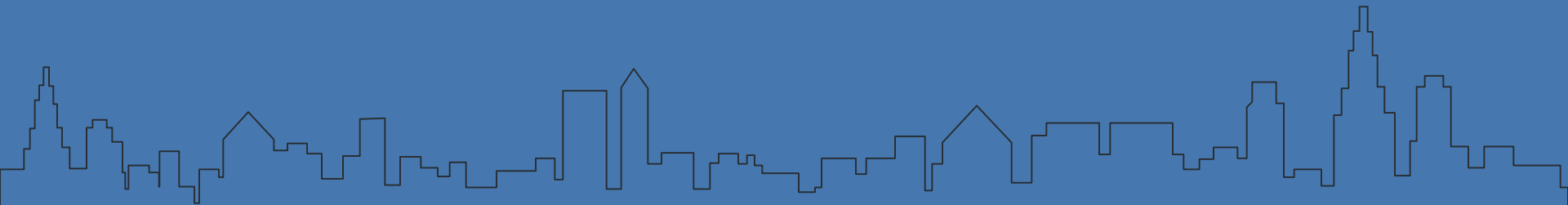




Experimental verification of the methodical system of development of future teachers' competence in electrical engineering

O. Borodiyenko, Y. Malykhina, L. Pavliuk, M. Pryhodij, A. Kalenskii

Institute of Vocational Education and Training of the National Academy of Educational Sciences of Ukraine,
Ukrainian Engineering Pedagogical Academy,
National Pedagogical University named after M. Drahomanov



The urgency of the research is determined by:

- ✓ Ukraine's integration into the European educational and research space
- ✓ ongoing vocational education reform in Ukraine
- ✓ process of transition to professional education in high school
- ✓ increasing requirements for professional training of graduates
- ✓ increasing market requirements for professionals
- ✓ the need to move from traditional academic style of teaching to innovative one
- ✓ contradiction between the market's need to train creative, purposeful teachers capable of continuous self-improvement, pedagogical interaction, and the inconsistency of content, methods and forms of education in higher education institutions (HEIs) that provide this training
- ✓ active implementation in the educational process the so called competence paradigms of education
- ✓ necessity of appropriate selection of content, methods, forms and technologies of teacher training, their active involvement in self-education, experience of cooperation with participants.

Purpose of the research is experimental verification of the methodical system of the development of future teachers' competence in electrical engineering which has been substantiated, designed and implemented within the process of future technologies teachers' training in HEIs in Ukraine.

Methods: theoretical analysis; empirical (methods of self-assessment, expert evaluation); statistical processing of data (including frequency analysis, use of statistical criterion for testing of hypotheses).

Key Statements:

- ✓ The *efficiency of development* of future teachers' competence in electrical engineering depends on the methodology, educational technologies and organization of educational and cognitive activities of students.
- ✓ The important component in such process is *scientifically substantiated and verified methodical system* based on model of competencies of future technologies teachers, theoretical foundation of competence based training and up-to-date scientific findings in pedagogy aiming continuous improvement of their pedagogical and technological knowledge and skills, personal and professional qualities, development of general culture, values, moral and ethical norms.
- ✓ The *methodical system* of the development of future teachers' competence in electrical engineering is based on a systematic approach to the study of pedagogical phenomena; theories of vocational education and training; theories of design of pedagogical activity and theoretical provisions of training of future teachers.
- ✓ The *main purpose* of such system is to improve pedagogical knowledge and skills of the future teacher, his/her personal and professional qualities, to develop students' general culture, values, moral and ethical aspects.
- ✓ The purpose of the system is *subordinated* primarily to the general aim of training, professional and personal development, and can be *decomposed* to partial goals aimed at developing individual components: ensuring a high level of motivation, raising the level of knowledge etc.
- ✓ It has been developed as a *set of structural and functional components* interconnected on the basis of purposefulness, adaptability, optimality, efficiency.

Purpose and methodology

The purpose is to improve pedagogical knowledge and skills of the future teacher, his/her personal and professional qualities, to develop students' general culture, values, moral and ethical aspects

Methodological approaches:

Competence-based, systematic, assessment-based



Content and technologies

Content: includes knowledge, skills and personal abilities that future teachers should possess.

Forms: extracurricular (consultations, clubs, competitions, conferences, workshops), classroom training, non-formal (research based on literature analysis, Internet surfing, conferences, attending exhibitions of modern equipment, internships, dual training).

Methods: visual (demonstration, illustration, followed by discussion and reflection, self-observation), practical (practical training, laboratory work, visual and research activities, project-based method), verbal (lecture, story-telling, explanation, instruction, consultation, discussion, coaching conversations).

Means: verbal (educational and scientific literature, didactic materials), technical (sound, screen, movies, multimedia), visual (schemes, diagrams, photographs, tables, boards, graphs), information and educational environment (electronic textbook, manuals, STEAM-laboratories, service platform systems etc.).



Assessment and results

The criteria and indicators of levels of development of future teachers' competence in electrical engineering: *cognitive* (knowledge on calculation of an electric circuit, electric cars of direct and alternating currents etc.); *activity-based* (mastery of basic laws and ability to solve technical problems); *personal* (interest in technical activities as an important component of training, interest in increasing knowledge and skills in electrical engineering); levels (initial, low, medium, high).

Results: improvement of pedagogical knowledge and skills, his/her personal and professional qualities, students' general culture, values, moral and ethical aspects

1. *Growing requirements* for teaching and teaching methods of electrical engineering disciplines.
2. Many problems remain relevant:
 - *providing labour market* with creative teachers with spiritual, technical and social potential;
 - focus on a *new perception* of educational material;
 - use of *interactive pedagogical technologies* that makes the learning process interesting, diverse, effective, democratic, students-oriented;
 - raising the intellectual level of students with the help of *information technologies* that help to receive, transmit, process and organize information
3. The highest level of methodical skill of a teacher in teaching electrical engineering disciplines occurs when the *theory is constantly connected with industrial training*, time is rationally distributed, and teaching methods are systematically improved.
4. To successfully conduct classes, it is necessary to *determine the ultimate goal of the teacher* (in advance, before its practical implementation). Vaguely formulated goal complicates the process of the teacher's activity and distorts the preliminary planned result).
5. The *components* of the Electrical engineering lesson (the content, teaching methods and forms of organization of the educational process) exist in conjunction and are determined by the purpose of the lesson.
6. The *main purpose of the lesson* is that students are fluent in the material presented. The process of achieving this goal is a consistent solution of such tasks as the acquisition of new knowledge and methods of action, independent exploration, the formation of a system of values.

Purpose: verification of the methodical system of the development of future teachers' competence in electrical engineering was empirical confirmation or refutation of the research hypothesis and, accordingly, the relevance of theoretical results.

Essence: the purposeful influence of the methods of teaching and content in order to develop students' knowledge and skills in electrical engineering.

Elements of influence:

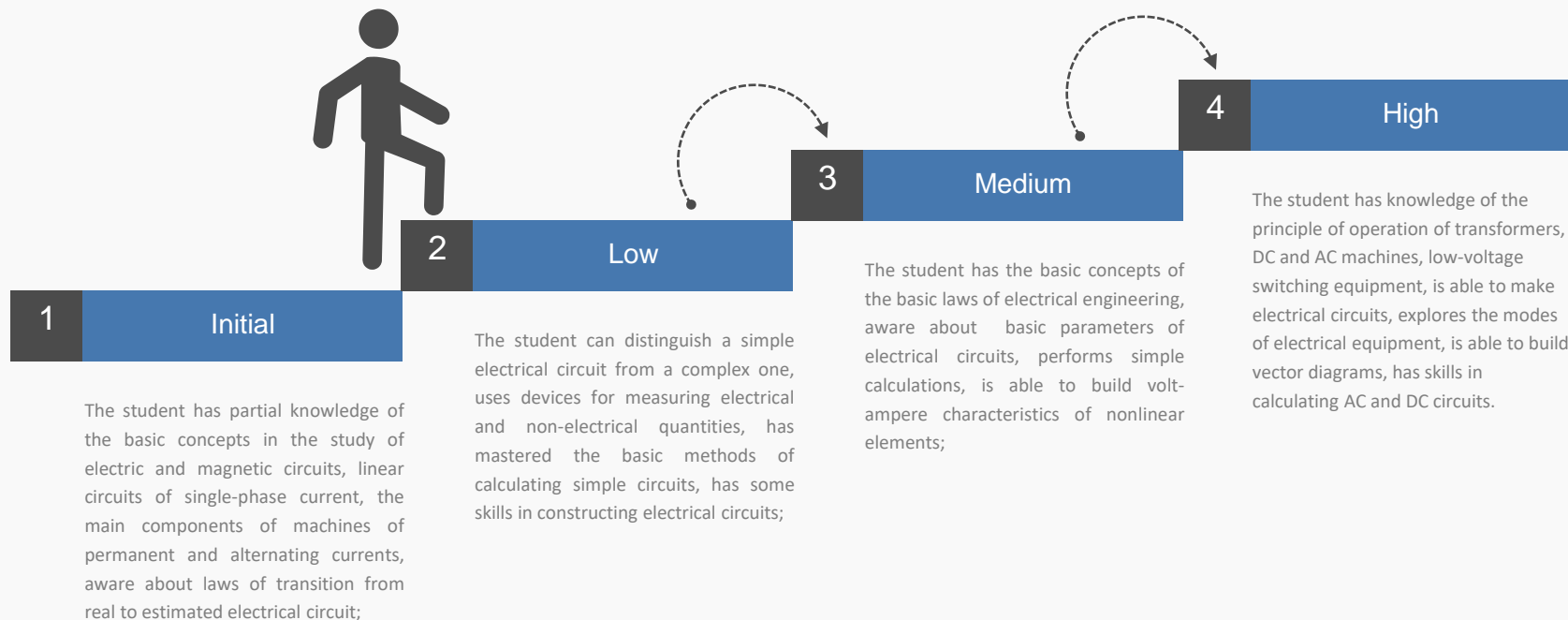
- specific content (defined on the basis of teachers' competence model and in accordance with educational program),
- methods of training (by time, by number of students, by place of study),
- forms of training (by source of information, by main didactic task, by essence of cognitive activity, by level of integrity),
- means of training (verbal, technical, visual, ICT and educational environment).

Algorithm of actions included:

- comparison of control (CG) and experimental (EG) groups and establishing the coincidence of their initial characteristics;
- realization of pedagogical influence on EG;
- based on the comparison of CG and EG after the implementation of the pedagogical impact of establishing differences in their final characteristics.

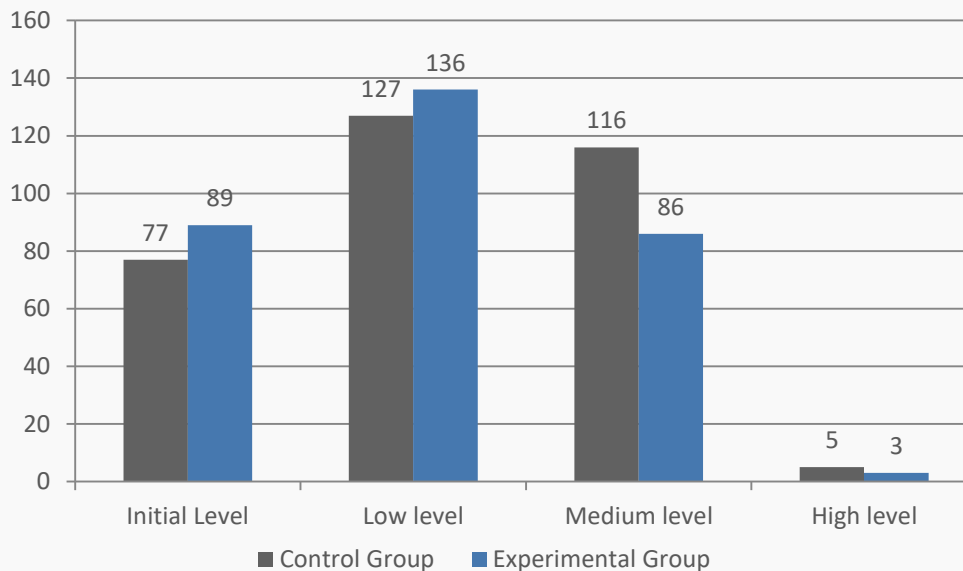
Four levels of development of future teachers' competence in electrical engineering:

8



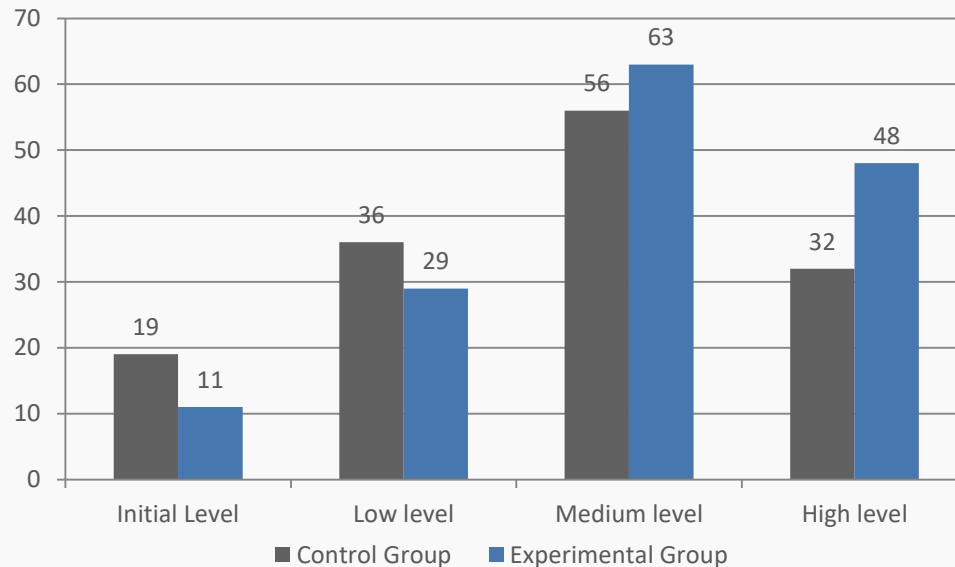
Quantity of students (by levels of development of future teachers' competence in electrical engineering (statement stage))

	Initial level	Low level	Midium level	High level	Total quantity
Control group	77	33	28	5	143
Experimental group	89	32	27	3	151



Quantity of students (by levels of development of future teachers' competence in electrical engineering (formative stage))

	Initial level	Low level	Midium level	High level	Total quantity
Control group	19	36	56	32	143
Experimental group	11	29	63	48	151



1. The level of competence in electrical engineering in the control and experimental groups were *statistically equal*.
2. Students in the experimental and control groups in the vast majority have a *low level* of competence in electrical engineering.
3. The *main reason* for the low level of competence in electrical engineering is the lack of mechanisms for their involvement in electrical-based activities in the classroom.
4. The proposed and implemented *methodical system* of future teachers' training allowed freedom of choice of courses, self-expression of talented students, ensured the implementation of the methodology of teaching and research - the latest educational models of training of tutors, coaches, facilitators, advisors, mentors, coaches.
5. After the implementation of the developed methodical system, there were *statistically significant changes* in the levels of development of future teachers' competence in electrical engineering.
6. The methodical system of development of future teacher's competence in electrical engineering has been successfully tested in the process of the formative stage of the experiment. Qualitative and quantitative analysis of the obtained results confirmed its *effectiveness* and the need to introduce in higher education pedagogical institutions.

Thanks for your attention!

Contact Us:



oborodienko@ukr.net