

Formation of Pedagogical University Students' Readness for Undergraduate and Graduate Research

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Abstract: There are many research opportunities for prospective teachers in Ukrainian pedagogical universities to gain their first experience of organization and conducting research work with students of various age groups and educational levels, in scholarly and scientific societies of various forms. Within the framework of this approach, the pre-service teachers' readiness for research work is an up-to-date issue that is in the focus of this paper. The study has been conducted in teacher training institutions of Central Ukraine with the experimental training group consisting of 186 students and 22 teacher educators, and the control group numbering 192 students and 25 teacher educators who took part in scientific and scholarly societies and groups or were in charge of undergraduate or graduate research. A model of students' engagement into active undergraduate and graduate research has been developed, incorporating the following integral parts: the objectives component (goals, tasks, approaches, and principles), the content-and-process component (stages, content, forms, methods, technologies, means), the process component (pedagogical conditions, forms, methods and means of teaching), and the results-and-evaluation component (parameters, levels, criteria, and indicators). A combination of empirical and theoretical research methods have been used to make the study conclusions more competent and authentic.

Keywords: *Undergraduate research; pedagogical conditions; content; form; methods; student research societies; student research groups.*

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1. Introduction

Harmonizing and aligning Ukraine's teacher education standards with those in EU country members necessitates the creation of high-quality research opportunities for prospective teachers and engaging them into active undergraduate and graduate research. As stated in the article (Yezhova, Pashkevich & Manoilenko, 2018), "scientific research is one of the intrinsic features at the university". There is a network of student scientific and scholarly societies in Ukrainian teacher training institutions where pre-service teachers acquire their initial experience of organization and conducting research with students of various age groups and educational levels. In order the research skills of pedagogy students would meet the present-day requirements, it is necessary to create the environment where mastering the experimental methods of research, the preparation and presentation techniques of diploma papers and master's theses should promote prospective teachers' growth into qualified educators with a strong research foundation.

Since the first decades of the 21st century, a large number of works appeared that explored contemporary principles and ways of research organization in institutions of higher learning, general aspects of students' research who major in finance, economics, transportation etc., namely the studies (Kersting, 2000), (Kovalchuk & Moiseev, 2018), (Filipenko, 2010). One of the pioneering papers devoted to the theoretical and practical issues of pedagogical research organization was written by an educationalist and methodologist Goncharenko (2012) who formulated methodological guidelines for young researchers. His ideas were further developed and enriched by such scholars, as (Artemchuk, Kurylo & Kochergan, 2015), (Pekhota & Yermakova, 2012), (Cherkasov, 2017). The study (Piatnitska-Pozdniakova, 2013) contains valuable data on the preparation of undergraduate students for research relating to a prospective professional area. The article by Kuzminskyi, Bida, Kuchai, Yezhova, & Kuchai, (2019) is devoted to the problem of the information support of teachers in the postgraduate education.

The results of the study by Areepattamannil & Santos (2019) conducted among teenagers in the 42 countries of the PISA 2015, revealed that students' perceived autonomy related to ICT usage was more strongly associated with their dispositions toward science than perceived competence in ICT usage.

The article (Lavery, Underwood, Matz, Posey, Carmel, Caballero, & Cooper, 2016) explores the motivation of college students in science

learning. The results of systematic review by Prieto Andreu (2020) indicates that gamification motivates students and improves their learning.

The research (Hanauer, Graham, & Hatfull, 2016) is an important contribution to the methodology of measuring persistence in the sciences of college students.

In the article by Rowland, Knapp, & Fargo (2020), the authors demonstrate a model for undergraduate student research skill development by writing collaborative book reviews.

Although different aspects of undergraduate and graduate research have been scrutinized frequently in recent years, more studies are required to yield a better awareness of its organization as the technology of new knowledge production in teacher training programs, accessibility for each student and their motivation to do research, its effect on prospective teachers' learning. Thus, the purpose of this study is to provide a rationale for the formation of pedagogical university students' readiness for undergraduate and graduate research by experimental verification of pedagogical operational conditions and developing a model of student engagement into active research.

The personal contribution of the authors of this article is presented in a number of scientific publications and speeches at international scientific and practical conferences on the problems of vocational training of students in higher education institutions, in the development of courses "Fundamentals of Scientific Research" and "Methodology of Scientific Research", which is provided by the curriculum bachelors and masters. The conceptual provisions of scientists are used by students in the process of passing pedagogical practice in general educational institutions of the I-III levels of accreditation.

2. Methods

This study uses both theoretical and empirical methods. *Theoretical* methods consist of analysis of the previous findings on the research problem that helped define the object, subject, content of the study, formulate its objectives, specify its key notions; modelling method for developing a model of pedagogical students' readiness for undergraduate and graduate research. *Empirical* methods include academic conversation – a dialogic method by which a teacher educator urges students to reproduce their earlier acquired knowledge by asking purposeful questions; testing for identifying the level of knowledge, skills and habits, abilities and other qualities of a personality; questionnaire used for gathering information by means of respondents'

written answers to a set of standardized questions; pedagogical experiment – ascertaining, forming, and control stages – for checking the study hypothesis; observation methods – overt and covert pedagogical observation, self-assessment and assessment; statistical method – tools of mathematical statistics for the data processing and validation, and unbiased estimation of experimental study findings.

3. Methodology of pedagogical students' engagement into active undergraduate and graduate research

A major key finding of this study is the development of a model (Fig. 1) of pedagogical students' engagement into active undergraduate and graduate research that incorporates the following integral parts: the *objectives* component (goals, tasks, approaches, and principles), the *content-and-process* component (stages, content, forms, methods, technologies, means), the *process* component (pedagogical conditions, forms, methods and means of teaching), the *results-and-evaluation* component (parameters, levels, criteria, and indicators).

The empirical study was conducted in Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Borys Grinchenko Kyiv Pedagogical University, Pavlo Tychyna Uman State Pedagogical University, Kryviy Rih State Pedagogical University. Experimental groups (EG) numbered 186 student-respondents and 22 teacher-respondents. Control groups (CG) consisted of 192 student-respondents and 25 teacher-respondents who were members of student research societies and groups or were in charge of their activities.

In accordance with the ethics of organizing and conducting the research, the procedure of participation in the experiment of students of the first and fourth courses of the above higher educational establishments and teachers of professional departments was considered and discussed at the meeting of the Department of Pedagogy and Management of Education Volodymyr Vynnychenko Central Ukrainian State Pedagogical (Minutes № 2 of September 03, 2019), Department of History and Theory of Pedagogy Borys Grinchenko Kyiv Pedagogical University (Minutes № 3 of September 16, 2019), Department of Pedagogy and Psychology of Child Development Pavlo Tychyna Uman State Pedagogical University (Minutes № 2 of September 11, 2019), Department of Pedagogy of Kryviy Rih State Pedagogical University (Minutes № 3 of September 10, 2019). With this approach, they obtained their consent to work in the control and experimental groups, and the teachers of these educational institutions to work as experiments.

Students' scientific or scholarly societies are voluntary organizations focused on the raising of student research levels, acquiring of skills for conducting research in various fields of general or professional education, training of specialists of a particular qualification level (Cherkasov, 2017). Students' research problem group is organized with the purpose of engaging students of different years of study and majoring in different fields into collaborative work on a research theme approved of by the chair responsible for teaching. The said research theme is defined in its most general form and further specified in a number of directions for research. In accordance with this range of research topics, students choose their individual research themes, and in collaboration with their research advisers plan their activity.

The methodological foundation of the formation of pedagogical students' readiness for undergraduate research was a set of research methods to reach the study objectives.

In order to carry out the experimental work, a complex of diagnostic techniques was formed, namely: motivation for research by Rean (2004); the technique for establishing the index of research activity (Cherkasov, 2017); Amthauer's intelligence structure test (Amthauer, Brocke, Liepmann, & Beauducel, 2001); Ch. Osgood's semantic differential (Osgood, Suci, & Tannenbaum, 1957); self-actualization test (SAT) (Filipenko, 2010); questionnaire "Sixteen personality factors" (16 PF) by Cattell (2009) for establishing the level of aptitude for research (Cattell & Cattell, 1995); focus group technique; diagnostic tests of communicative and organizational abilities (Pekhota & Ermakova, 2012). All the above mentioned methodologies are directed at the formation of personal value orientations and motifs/ research competencies, generalization of integration possibilities of key subjects, research construction and realization skills, planning skills in accordance with the predicted forms and means, acquiring skills and habits of conducting and assessment of research results.

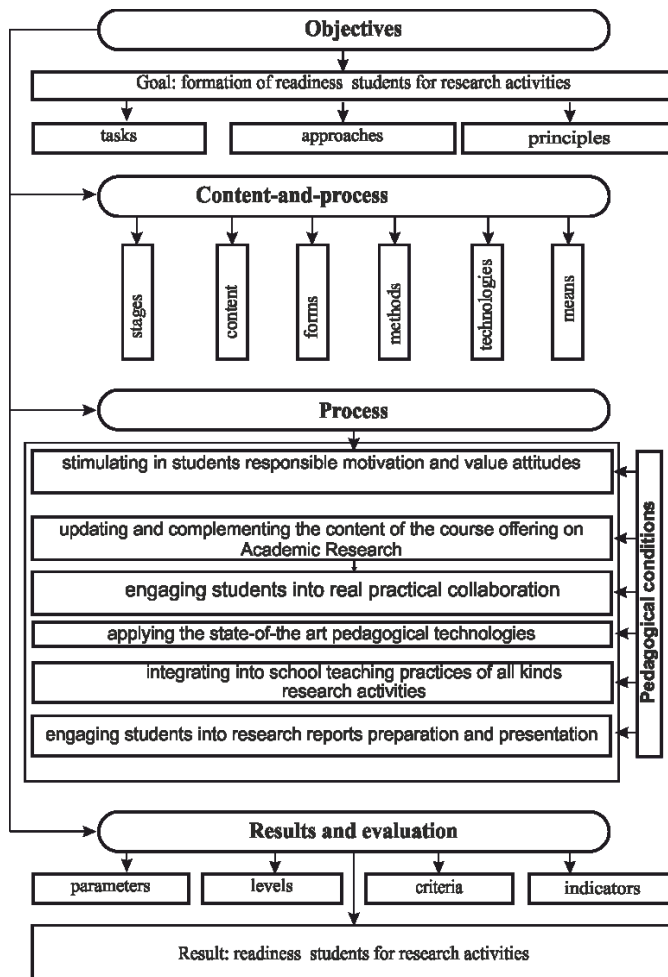


Fig. 1. Model of pedagogical students' engagement into active undergraduate and graduate research

As proved by the findings of the ascertaining stage of the experiment, prospective teachers' readiness for research shall be more efficient, if the following pedagogical operational conditions are adhered to:

- stimulating in students responsible motivation and value attitudes to acquiring research competencies in the process of their active participation in undergraduate and graduate research;

- updating and complementing the content of the course offering on *Academic Research* with quasi-professional tasks for acquiring a set of research knowledge and competencies concerning the organization and conducting research in accordance with its theme;

- engaging students into real practical collaboration in educational environment, into active and intellectually creative activities in students' scholarly and scientific societies and groups;

- applying the state-of-the art pedagogical technologies by optimal combination of interactive approaches and innovative methods of research organization;

- integrating into school teaching practices of all kinds research activities with secondary school students, implementing experimental techniques with respondents from control and experimental groups;

- engaging students into research reports preparation and presentation at research conferences of various levels with the purpose of acquiring skills of independent creative research, archive reference sources research, developing creative thinking and gaining proficiency in research.

The primary objectives of a students' research society consists in: searching for and giving support to new, talented researchers in the student community; ensuring all the necessary conditions for the development of research and creative potential of prospective researchers; stimulating the initiative in organization of undergraduate and graduate student research activities; developing the creativity of thinking and mobility in interpretation of scientific truths and phenomena; information exchange within the student community during presentations at research conferences of various levels and types; promoting international research and cultural collaboration; giving practical assistance in publishing research papers and implementation the results into educational practices.

The main directions of students' research society embrace: facilitating the organization of student research societies and stimulating their activity; coordinating the work of university departments, research advisers and students on improving research projects; providing information support of undergraduate and graduate students in conducting their research; organizing student conferences, Olympiads and round table discussions on various issues of pedagogical education.

In the experimental groups, the following innovative forms, methods and ways of the desired scholarly competencies formation were used: gaining knowledge on research fundamentals; getting acquainted with experiment organization and conducting; developing techniques and pedagogical conditions of research; gaining proficiency in working with reference sources, recommendations for preparation of reports, essays, presentations; drafting texts of articles and theses to submit for conferences. In control groups, the objectives were focused on knowledge acquisition and skill

formation, defined by the curriculum as essential for prospective professional activity.

The quality of research work of students and teacher educators is largely dependent on its content planning and organizational functions devoted to engaging students into research activity. Thus, the content of a student research society's sitting that took place on a monthly basis was discussed at prior individual student-research advisor meetings. The plan of student's research presentation was made, chunks of experimental work were outlined. The teacher educator in charge of a research society or group focused the students' attention on the main directions of the research conception, helped chain students' attention to the key factors that influenced or might influence the results of an experiment, channeled students' efforts at an adequate choice of research methods, unbiased presentation of research material.

It should be underlined that an important role in the organization of research is played by mutual understanding and psychological compatibility of the views of research advisors and their charges on possible variants of a research problem solution. Within the framework of common prediction of directions, program and methodology, organizational structure and an experimental part of the research, shared approaches to reaching the research goal and objectives appear, the expediency of the declared pedagogical conditions finds its confirmation.

It is worth emphasizing that forms of students' research in research societies depend upon the goal and aims the advisor puts forth in each particular case. They can include sittings at which students' reports can be presented, workshops, trainings, discussions and master-classes. Furthermore, students can gain proficiency in techniques of research organization, preparing and conducting experimental work, summarizing the obtained results, mastering methods of using reference sources, learning the particulars of working with archives.

Students' active participation in research societies of various types resulted in research publications in the form of papers and theses, reports at scientific and academic conferences, preparation for the defense of course papers, diploma papers, master theses, participation in Olympiads and competitions of students' research works at the international, national, regional and university levels.

4. Results

The quality of formation of pedagogical students' readiness for research largely depends upon purposefully developed model of engaging students into active research that should incorporate the following core components: the *objectives* component (goals, tasks, approaches, and principles), the *content-and-process* component (stages, content, forms, methods, technologies, means), the *process* component (pedagogical conditions, forms, methods and means of teaching), the *results-and-evaluation* component (parameters, levels, criteria, and indicators).

The results of measuring of the students' readiness for research before and after the formative experiment are presented in Table 1 and are visualized with a bar chart (Figure 2)

Table 1. Computation and measurement of level of students' readiness for conducting research, according to the formative experiment findings

Readiness level	Before experiment				After experiment			
	CG		EG		CG		EG	
	students	%	students	%	students	%	students	%
Low	46	24,0	49,0	26,3	41,0	21,4	27,0	14,5
Medium	99	51,6	94,0	50,5	94,0	49,0	83,0	44,6
High	47	24,5	43,0	23,1	57,0	29,7	76,0	40,9
Total	192	100	186	100	192	100	186	100
χ^2	0,31				6,19			

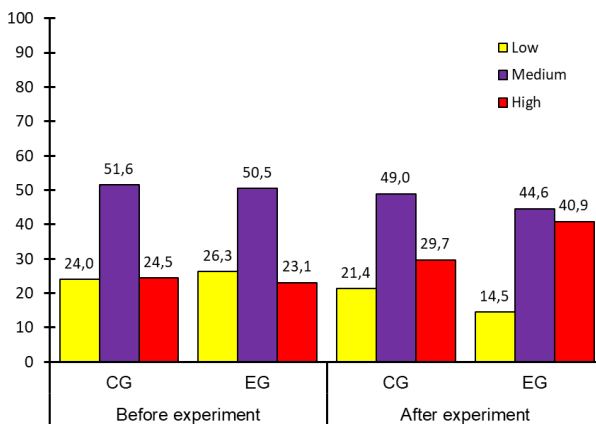


Figure 2. Levels of students' readiness for conducting research, according to the formative experiment findings

A method of inferential statistics was used to define a statistically significant difference between the experimental and control groups with the help of criterion χ^2 by way of comparison of the obtained index with the table index for the number of graduations 3 and the significance level $\alpha=0,05$: $\chi^2_{0,05}= 5,99$. The similarity of characteristics of the control and experimental groups before the beginning of the experiment was proved ($\chi^2=0,31$), and also the difference between the control and experimental groups after completion of the experiment was defined ($\chi^2 = 6,19$).

Our findings on the quality optimization of pedagogical students' readiness for research obtained in this study with mixed theoretical and empirical methods suggest that:

1. Content planning and conducting organizational pedagogical functions aiming at formation of prospective teachers' readiness for research are at a high level.

2. On the basis of the data compilation, a percentage ratio was calculated for the correlation of the experimental group students' levels of their readiness formation for research: high level – 23,1 %, medium level – 50,5 %, low level – 26,3 %, and of the control group students' level – 24,5 %, 51,6 %, 24,0%, respectively.

3. Experimental work in the control group ensured growth of high level of pedagogical students' readiness for research by 5,2 % in comparison with the ascertaining phase; medium level decreased by 2,6 %, and low level decreased by 2,6 %. In the experimental group, high level increased by 17,8 %, medium level decreased by 5,9%, and low level decreased by 11,8%.

4. In sum, the difference between high level of students' readiness formation in control and experimental groups constituted 11,2 %, medium – 4,6 %, low – 6,9 %, as testified by the results of experimental work.

This study findings demonstrate that before the organization of research the students of experimental and control groups were at approximately the same level of their readiness for undergraduate and graduate research; after conducting the experimental work, the students' from the experimental group demonstrated higher results, leading to the conclusion that the purposeful process organization of the students' readiness formation for research facilitated the significant increase of their readiness level.

5. Conclusions

The findings of this study and the significance of the problem under analysis for the teacher education suggest that undergraduate and graduate

research of prospective teachers in scientific and scholarly societies, problem groups and circles should be a purposefully planned collaboration of the student and research advisor. A diagnostics of formation of pedagogical students' readiness for research, carried out in this study, included the monitoring of the process of its formation and the ascertaining experiment. The monitoring findings on the content of general and professional courses, offered by the curriculum of teacher education programs, testify that the majority of them provide sufficient information on theoretical and practical aspects of how research should be organized and carried out by the students of higher learning institutions. Our study suggests a set of pedagogical operational conditions facilitating the quality of student research: stimulating in students responsible motivation and value attitudes to acquiring research competencies; updating and complementing the content of an academic research course offering with quasi-professional tasks; engaging students into real practical collaboration in educational environment; applying update pedagogical technologies; incorporating research activities with secondary school students into teaching practices at school, and stimulating experimental work; engaging students into research reports preparation and presentation at research conferences of various levels with the purpose of independent creative research skill acquisition and education of prospective teachers with a strong research foundation.

The conducted study does not exhaust all aspects of the problem of undergraduate and graduate research content and organization in teacher training universities. Further studies might explore the correlation between students' academic proficiency and their active participation in research, the significance of research skills obtained by the students in undergraduate and graduate research societies and the new teacher continuous professional development (CPD). A promising direction may be a comparative study of international experience of student research organization and content.

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