



ПЕДАГОГІЧНІ НАУКИ

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Bendera I.M.

Dr.Sc. (Pedag. sciences), Professor, Head of the Department of Physics, Mathematics and General Technics disciplines

E-mail: ivan_bendera@mail.ru

Pancyr J.I.

Ph.D. (Techn. sciences), Associate Professor, Dekan of Engineering Faculty.

E-mail: panzir_yuriy@mail.ru

Garasymchuk I.D.

Ph.D. (Techn. sciences), associate Professor, Head of Department of Energy and electrical systems in agriculture

E-mail: igor_gera@mail.ru

State Agrarian and Engineering University in Podilya
Kamianets-Podilskyi, Ukraine

CROSS-CUTTING PRINCIPLE IN INDEPENDENT RESEARCH ACTIVITY OF AGRARIAN UNIVERSITY STUDENTS

Бендера І.М.

д.пед.н., професор, завідувач кафедри фізико-математичних і загальнотехнічних дисциплін

E-mail: ivan_bendera@mail.ru

Панцир Ю.І.

к.т.н., доцент, декан інженерно-технічного факультету

E-mail: panzir_yuriy@mail.ru

Гарасимчук І.Д.

к.т.н., доцент, завідувач кафедри енергетики та електротехнічних систем в агропромисловому комплексі

E-mail: igor_gera@mail.ru

Подільський державний аграрно-технічний університет
м. Кам'янець-Подільський

НАСКРІЗНІСТЬ В САМОСТІЙНІЙ ТА НАУКОВІЙ РОБОТІ СТУДЕНТІВ ВИЩИХ АГРАРНИХ НАВЧАЛЬНИХ ЗАКЛАДІВ

Abstract

Introduction. The search of new educational technologies, organizational and instructional techniques of students' research work and individual study intensification is an urgent problem nowadays.

Methods. The author used methods of empirical research, s. a. observation, comparison, measurement, experiment and theoretical research methods, s. a. functional and systems analysis.

Results. The author provides the theoretical research on the development and implementation of educational technologies in the organization of research work and individual study of agrarian and engineering specialties students. Basic teaching organizational and instructional techniques for conduction of students' research work and individual study are presented due to crosscutting principle in agricultural higher education.

Discussion. The study shows that self-planning of research and individual work is the promising method for implementation within the regional higher education and research centers, as well as vocational schools in process of tuition of the vocation-related subjects.

Keywords: cross-cutting principle, independent work, research, coursework, graduation projects, educational technology.

Анотація

Вступ. Пошук нових педагогічних технологій та організаційно-методичних прийомів активізації науково-дослідної та самостійної роботи студентів є актуальною проблемою сьогодення.

Методи. При написанні статті використовувались методи емпіричного дослідження - спостереження, порівняння, вимірювання, експеримент, та методи теоретичних досліджень – функціональний та системний аналіз.

Результати. Наведено результати теоретичних досліджень у розробці та впровадженні педагогічних технологій з організації самостійної та наукової роботи студентів агроінженерних спеціальностей. Викладені основні педагогічні організаційно-методичні прийоми з проведення самостійної та наукової студентської роботи за наскрізним принципом у вищих навчальних закладах аграрної освіти.

Перспективи. Розроблена методика планування самостійної та наукової роботи для різних масштабних вимірів є перспективною для впровадження у межах вищих регіональних освітньо-наукових центрів, окремих навчальних закладів і освітньо-кваліфікаційних рівнів та окремо взятих профільюючих дисциплін навчального плану

Ключові слова: наскрізність, самостійна робота, наукова робота, курсові роботи, дипломні проекти, педагогічна технологія.

Аннотация

Вступ. Поиск новых педагогических технологий и организационно-методических приемов активизации научно-исследовательской и самостоятельной работы студентов является актуальной проблемой современности.

Методы. При написании статьи использовались методы эмпирического исследования - наблюдение, сравнение, измерение, эксперимент, и методы теоретических исследований - функциональный и системный анализ.

Результаты. Приведены результаты теоретических исследований в разработке и внедрении педагогических технологий по организации самостоятельной и научной работы студентов агроинженерных специальностей. Изложены основные педагогические организационно-методические приемы по проведению самостоятельной и научной студенческой работы по сквозным принципам в высших учебных заведениях аграрного образования.

Перспективы. Разработана методика планирования самостоятельной и научной работы для различных масштабных измерений является перспективной для внедрения в рамках высших региональных образовательно-научных центров, отдельных учебных заведений и образовательно-квалификационных уровней и отдельно взятых профилирующих дисциплин учебного плана.

Ключевые слова: насквозность, самостоятельная работа, научная работа, курсовые работы, дипломные проекты, педагогическая технология.

Introduction. Science is an essential component of human culture. Regarded as a system of people's knowledge, it covers not only actual information about the outside world, human thought and activity, not only laws and study principles, but certain forms and ways of their conceptualization. Due to the fact that science is considered as a form of social consciousness the scientific research stays a form of social activity.

Student engagement in independent research activity (SIRA) has always been an integral and required component of highly qualified specialist training. Thus, the key issue facing modern higher education is the search for new educational technologies to enhance student research activity.

Analysis of recent research and publications. Since Soviet times student involvement in research activities, including participation in research and academic competitions, workshops and conferences, have been considered as one of the most promising ways to improve the quality of student training, especially in engineering sciences. Though, the most progress in SIRA organization has been made during the second half of the 1990s.

Consequently, SIRA was developed into a complex system and became an inherent part of educational process within higher educational institutions. It is noteworthy that degree course scheme at almost all agrarian and engineering universities in Ukraine include a required course 'Basics of scientific research'.

Ordinarily, students' coursework and diploma projects are based on researches carried out in student scientific societies under a supervision of professor or associate professor. Therefore, student scientific research supervision is included into academic staff schedule. Moreover, admission to doctoral programs tends to be made on the criterion of students succeeding at research activity.

Indeed, research supervising helps the academic staff to get a coherent picture of the student they work with. As a result, they get rather full and objective overview of his abilities, propensity to creative thinking, discipline and other human qualities. We can therefore assert that such kind of scientific research collaboration supplements the theoretical material from textbook, encourages creativity and critical thinking focusing student on the search for solutions to solve practical problems.

The beginning of new millennium has been marked by a spontaneous destruction of SIRA system. Today this trend continues on the account of the fact that modern SIRA generally stays episodic and random, losing its link to the learning process. Student research activity is no longer included into academic staff's individual curricula, has lost its diversity based on academic level or educational degree.

Recently, in terms of economical and political transformations, some occasional attempts to restore the SIRA system have been provided by the Ministry of Education and Science of Ukraine. However, the establishing of a new students research activity system remains one of the central challenges of higher education in Ukraine. This comes in response to the need in passing on to another level of student research activity system.

As practice shows, the cross-cutting principle is the most appropriate way to organize such kind of educational process. It means research work, including but not limited to classroom hours, to be integrated into all academic levels, differentiating by the year of study etc. Inclusion SIRA in the academic staff's individual work plan, as well as students' curriculum, would set clear the recognition in public policy of the student research activity as a mean for improving the quality of professionals training.

General basis of such pedagogical principles as continuity, advance in education and cross-cutting as one of the forms of advance in teaching have been widely discussed. Some specific aspects of these problems can be found in publications by I. Zyzyun, N. Nychkalo, S. Goncharenko, S. Sysoeva, A. Rudnytska, R. Gurevich, A. Gryshchenko, L. Puhovskoyi, M. Soldatenko [1-7].

The solution requires an integrated approach to planning and conduction of student research activities into educational process. Cross-cutting form of student independent research activity needs to be put into practice of educational process starting from the first year of study at university and providing links with his future graduate thesis. However this problem calls for a creative approach, including development of complex scientific topics, further coordination with academic disciplines, unsupervised activities and practical training.

Therefore, complete rethink of student research activity system within ECTS system of educational process have to be provided, paying special attention to rational organization of student research work according to the cross-cutting principle. This includes academic advising during essay writing, calculation and graphic assignments with elements of research, as well as course projects performance, provided with a common thematic focus and long-run objective being contained in graduation project (master thesis) [8]. In addition, specifics of educational and qualification programs and educational qualification characteristics of Bachelor and Master degree in mechanization and electrification of agriculture, as well as engineering teachers training aspects also need to be factored.

The main problem of implementation of research content into educational process resides in its theoretical substantiation and supporting of the cross-cutting research activity during training of highly specialists within undergraduate, graduate and post-graduate programs at agrarian and engineering educational institutions according to traditional or credit transfer system of educational process organization.

Purpose. To achieve this goal the following problems should be solved:

1. Analyze of current cross-cutting programs of student independent research activity within different educational systems. Identifying common patterns, risks and benefits, trends etc.
2. Substantiation of the main directions and pedagogical conditions of the cross-cutting principle of training process organization.
3. Development of the cross-cutting principles of research activity in multistage vocational and professional training of agrarian and engineering specialists.
4. Submitting the methodology, layout and application of the cross-cutting principle of research activity organization in its theoretical, practical, and vocational forms, taking into account all the actors of educational process, in particular students, academic (pedagogical) stuff and supervisors.
5. Forecasting of possible complications caused by technology adoption into educational process in order to identify the ways to solve them.

Methods. The current investigation involved the use of empirical research methods, such as observation, comparison, measurement, experiment and theoretical research methods, such as functional and system analysis.

Results. Higher educational institutions function as subjects of scientific activity. Elements of scientific activity, performed by first year students, postgraduate students and young scientists at scientific clubs, encourage formation of their research skills.

Student research activity is carried out in two related areas:

- 1) development of research skills and elements of organization and methodology of scientific work;
- 2) student research activity, provided under professors, associate professors and academic staff supervision.

The content and structure of student research activity are defined by the continuity of its means and forms according to the logic and sequence of the learning process, that leads to a gradual increase in the complexity and growth of acquired knowledge and skills.

Current approaches help to identify the critical pass of this activity, which essentially coincides with research stages [595, 601, 615]:

- 1) choice of problem or issues of the research;
- 2) reviewing the state of the chosen problem;
- 3) specification of theme (problem) and a program of the research (thematic justification, relevance, purpose, novelty, hypothesis etc.);
- 4) accumulation of research information;
- 5) systematization of research results;
- 6) theoretical analysis of the survey results;
- 7) execution of research results;
- 8) implementation of research results;
- 9) assessment the significance of the study.

The first step towards the development and implementation of cross-cutting research themes into the educational process was taken at the Institute of Mechanization and Electrification of Agriculture, State Agrarian and Engineering University in Podillya. Cross-cutting principle of pursuance of the graduating research has been introduced as a part of curriculum of students of three specialties for Junior Specialist, Bachelor and Specialist educational qualification levels. The main idea is that the maximum number, and if possible all student coursework and projects are carried out within the same thematic direction (Fig. 1).

This educational technology provides that the graduate project theme as a "research direction" to be selected (appointed) during student's first year of study by the graduate project supervisor. The research project scheme has to be drawn up for the entire period of study and realized through essays, term papers (projects), research tasks during educational, internship and pre-graduation practice etc.

Students use these elements of research as a form of scientific inquiry during writing term papers of courses in general and specialized disciplines. They prepare literature reviews and make proposals containing elements of novelty, summarize the best experience, use economic and mathematical methods, office equipment and information technology.

Subsequently, these elements of scientific inquiry expands within the graduate paper (project), in a view of the fact that all gained skills represent student's ability and readiness for theoretical understanding of the chosen topic relevance, its scientific and practical importance. As a result, student is ready to perform an independent scientific research, as well as to apply its results practically during work experience internship in the business environment.

That is why the theme of the graduate project have to be closely related to the department area of research and (or) the focus area of the company, on the basis of which student performs his project.

During practical and internship training each student performs certain research tasks in addition to overall program assignments. Tasks execution is displayed in the internship diary and in a separate section of the practical training report. Attained results can be used for producing reports for conferences and informational seminars, as well as writing term and graduate papers.

Students who have achieved some success in research activities may study on personal schedule within the prescribed period of study. State Examination Committee has a right to recommend these students for admission to the Master's, Doctoral program or a scholarship post.

The only difference is that the list of term papers (projects) is supplemented by the maximum number of small individual research assignments (reports, calculation, graphic works, settlement and graphic works, creative tasks, additional tasks, descriptions of practical research tasks) due to their enrollment to the final research work – the degree project (Master's thesis).

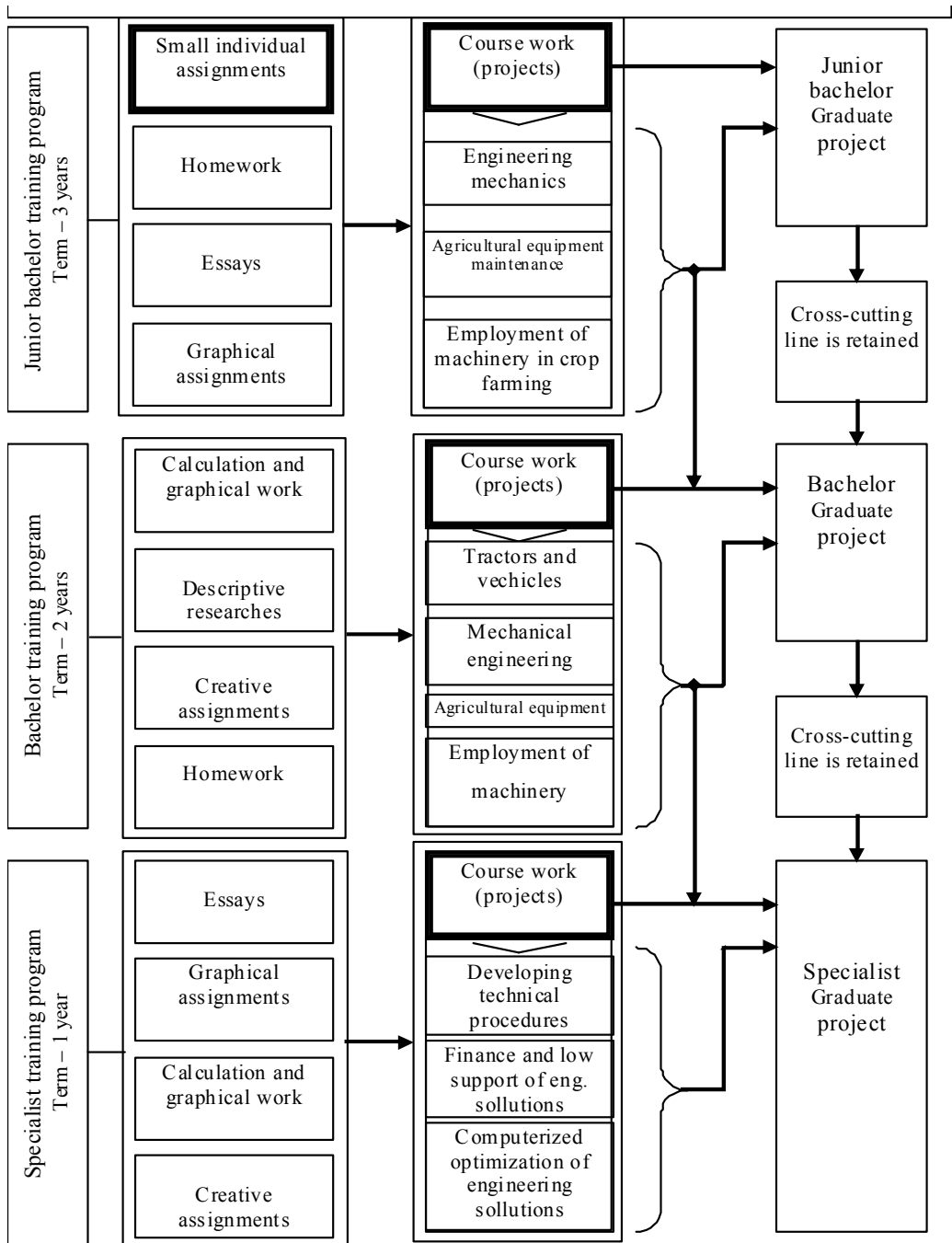


Fig.1. The scheme of cross-cutting graded independent research activity
(for program subject area ‘Agricultural engineering’)

The most intensive scientific work is conducted during the preparing of the discipline-specific course paper. Within credit transfer system every academic discipline is suggested to finish with a training project (academic and research tasks) (ART).

Supervisor maps the cross-cutting educational pattern of student's independent research activity. It is necessary to observe the following rules:

1. Choose a topic of the course project scientific section from the general cross-cutting scheme, composed by the graduate paper supervisor.
2. Use the maximum number of small research assignments from basic discipline in general cross-cutting scheme composing.
3. Add into the general cross-cutting scheme small research assignments given while studying related courses during the same semester.

These kinds of schemes are rather complicated for realization but extremely efficient in terms of the cross-cutting principle of student research activity. However, suggested educational methodology maximizes the requirements for term and graduate project's supervisors on account of the fact that they ipso facto are the scientific supervisors.

They are required to be able to plan and design the methodology of the project, i.e. student scientific research, 5 years ahead, to provide matching theme for essays, term papers (projects), practical and research assignments, at the same time predicting its general value for the entire graduate project. Due to that kind of reassignment of the role of university academic staff, term and graduate research advising should be provided by scientific and pedagogical employees with experience, creative engineering thinking and punctuality in carrying out continuous monitoring of student scientific research.

Furthermore, our experience of application of cross-cutting student research activity system has shown its undoubted advantages, prospects and opportunities for improvement. During laboratory sessions students hone their basic research skills, e.g. empirical data handling methods and procedures, its graphical interpretation, information technology using etc.

We may assume the effectiveness of cross-cutting technologies combining for student independent research activity organization. Integrated cross-cutting scheme of student independent research activity system has been field-tested within engineering students training program at the State Agrarian and Engineering University in Podillya.

An important feature of the most part of course projects devoted to machine hardware drafting or improving is the scientific research section, including analytical literature review, computer based calculations, economic forecasting and explanation of engineering solutions etc. In many cases attained results may be taken on a cast of innovation proposals, patents, trademarks, information materials, scientific papers etc. Most of them stay just a part of educational process, but some get the status of the item of intellectual property, being noticed by patent office, scientific publishing houses, centers of scientific and technical information, etc.

Discussion: 1. In this paper we presented the basic model of cross-cutting scheme of student independent research activity system. The cross-cutting technology is based on the principle of individual programming of all its elements at the undergraduate level, focusing on the future graduate project theme and involving small individual assignments, coursework etc.

2. The method of student research activity cross-cutting planning as a creative diversity of independent work for the entire period of study has been developed.

3. It is noted that the effectiveness of student independent work, its intensesness and closeness to the general aim, that is the defense of the graduate project for professional qualification, is directly related to less important technologies based on the cross-cutting principle. There is an inextricable connection between essentially independent research activity and a course scheme of practical training in educational laboratories, workshops, as well as production facilities, organizations, companies etc.

4. It is proved that during independent work planning two following components should be taken into account: student's working time arrangements with reference to his individual assignments and teacher's schedule on account of his role as full-value subject of the educational process and independent research activity supervisor. The educational mechanism of independent work programming in terms of its main components (preparation for classes, individual independent work (project work), independent work during laboratory practice, student research work, independent work organized at the department) has been recommended.

5. It should be noted that student independent research activity should be viewed as a set of organizational and methodological activities of all of the educational process subjects at the stages of planning, current and final control and debriefing.

6. The method of independent research activity planning for different scale of measurement, within regional higher education and research centers, schools, educational levels and individual curriculum, has been developed.

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