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RESEARCH ACTIVITIES /
ИЗСЛЕДОВАТЕЛСКА ДЕЙНОСТ

MODERN METHODS OF TEACHING AGRICULTURAL DISCIPLINES IN VOCATIONAL HIGH SCHOOLS OF AGRICULTURE

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Abstract. The mission of the agricultural sciences has always been to seek how to grow crops and manage farm animals in order to produce high quality and quantity food and fiber to satisfy the needs of an ever-growing population. In the modern world, the quality training of agricultural specialists starts from the high school stage. Vocational agricultural education is one of the most effective and powerful tools in society which moves humanity forward and cares for the sustenance of all mankind. The present article examines the modern concepts of agricultural education and analyses the teaching methods in agricultural study program. It also describes in detail the modern teaching methods, their purpose, advantages and disadvantages. This article recommends the implementation of modern teaching methods, as it finds that they would ideally fit into the modern students' idea of a learning process suitable for the new era of artificial intelligence (AI), technology and digitization.

Keywords: high school; agricultural sciences: agricultural education; vocational education; modern teaching methods

Introduction

Since the last century, agricultural scientists, engineers and farmers have been unlocking the laws of nature that govern plant (field crop and horticulture) and animal production (dairy, beef, and poultry). Over the years, humanity has seen astonishing successes of research, education, and community outreach in animal sciences (egg and meat production), dairy science (milk production), and closely related disciplines (agronomy, soil science, agricultural engineering, animal feed industry and greenhouses etc.).

According to the National Association of Agricultural Educators (NAAE), there are approximately 1 000 000 agricultural education students who are taught by nearly 12 000 secondary and two-year postsecondary teachers. The NAAE notes that agricultural education is derived from three interconnected components: classroom instruction; experiential learning; and leadership education. Agriculture

education grants play a central role in helping schools, government agencies, and non-profit organizations provide these components.[1]

Agricultural education is referred to "agriscience" and „vocational agriculture". Basic teaching in agriculture at the elementary, secondary, postsecondary, or adult level to gain competent human resource for agricultural sector meets state and sectoral requirements as part of a career and technology instructional program (Phipps and Osborne 1988; Şahin et al. 2016, p. 18). Interestingly, the lack of first-hand agricultural experience in our current student population has provoked a resurgence in the demand for practical and hands-on courses (Kensinger and Muller 2006; Şahin et al. 2016, p. 18).

Today, students have a huge option to choose from in preparing for futures that may include graduate school or veterinary school, careers in production agriculture (i.e., farming), sales and services, communication, marketing, finances, or business consulting with the allied industries (seed, feed, nursery, equipment, processing, etc.). Given the extent to which agricultural sciences prepares students for a farming-related profession, the discipline is not unlike the other professions, such as medicine and law, that have clear, well-established signature pedagogies (Shulman 2005; Şahin et al. 2016, p. 18).

The teaching and learning of an applied science like agricultural science consists of learning facts and figures, rules, laws formulae, problem solving, understanding of basic scientific principles of concepts and explanation of concepts and observed phenomena (Ampiah 2002; Darko et al. 2015, p. 14). It is therefore of utmost significance for the teacher to use the appropriate pedagogy to bring to good understanding and learning of a particular learning task. There are important aspects of agricultural science like understanding of basic scientific concepts, problem solving based on observed phenomenon require a good understanding as well as explanatory and problem-solving ability of the student concerned. Unfortunately, students tend to memorize concepts that require analytical thinking and basic knowledge in the concept concerned due to the subject been more theoretical than practical (Darko et al. 2015, p. 14; Resmick 2000).

Facts, rules and laws are memorized but often this information is not connected in a coherent framework that would allow students to make sense of it and therefore learning does not take place. It is, therefore, very important for any professional teacher to know what decision to make, when to make them and the effect of such decision on the teaching-learning encounter. These decisions, which give direction, purpose, meaning and structure to classroom interaction, provide teaching with its professional touch (Darko et al. 2015, p. 14).

1. The conception of "agricultural education"

It is not sufficient to make one sentence definition of agricultural education. The world book Encyclopaedia defines agricultural education as instruction in

agriculture useful to farmers, to those engaged in non-formal agricultural occupation and to all persons as part of the general education. It is the training of learners in the processes of agricultural productivity as well as in the techniques for the teaching of agriculture (Ogbuoka & Ajibo 2023, pp. 1 – 2). According to Olaitan et al. (2018) it is teacher preparation in agricultural production and in pedagogical skills in agricultural subject areas.

Agricultural education refers to the teaching of skills, values, attitudes, and related products (Egbule 2014; Ogbuoka & Ajibo 2023, p. 2). Therefore, agricultural education is the type of education that is employed in training learners in the improved agricultural production process as well as in the techniques for the teaching of agriculture. It therefore, takes place at two levels, namely formal level which would take place at primary, secondary to graduate study in the university; and at informal level which goes on outside the formal school system (Ogbuoka & Ajibo 2023, p. 2).

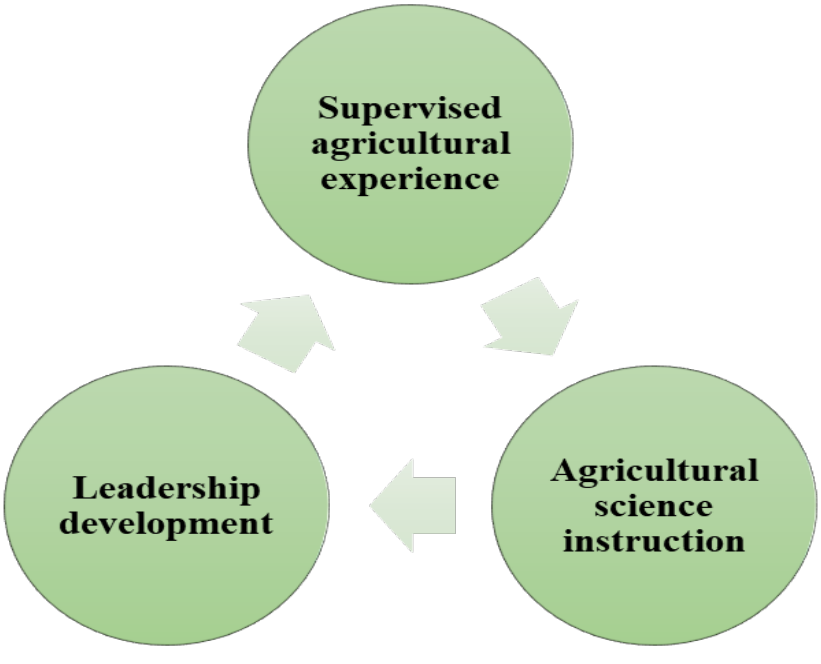

Figure 1. Components of an agricultural science (literacy) program in the concept of agricultural education.

2. Teaching methods in agricultural study program

Because of its specificity, the goal of teaching methods in the field of agricultural science is that students memorize new course material, which is often necessary

to be deepened by the additional curriculum content, and to apply theoretical knowledge in practice in order to prepare to face various challenges in the future entry into the labour market. According to Klafki (1971) teaching methods are used to enable the successful teaching and successful learning for students.

Teaching and learning are always directed towards contents oriented to the main target(s) – the knowledge or cognition, behaviours or attitudes, abilities or skills. For the implementation of successful teaching process it is necessary to choose teaching methods which primarily encourage curiosity, independence in work, ambition, agile mutual communication, ability to adapt to the given situation as well as desire for independent research and solving the anticipated problems.

Prior to researching, trying out or giving statement about which way or which method, in the given framework conditions, is more or less appropriate for a desired process of teaching and learning, one must know the goal(s) as well as chosen contents depending on the objectives that should be passed on by teaching and adopted by learning process. In addition to the clarity and individualization, a variety of methods often stand out as another component of the expertise of teachers in the vocational high schools.

In the teaching process in the field of agricultural sciences, the correct selection of the appropriate teaching methods is of utmost importance and largely depends on the substantive reasons, but also a large number of organizational- technical capabilities of higher education institutions where teaching is implemented. According to Cvetković et al. (2015) teaching methods to be applied within particular subject largely depend on the convenience of content for the presentation through the particular form of the teaching process.

Creative teaching process in the field of agricultural sciences should be based on the development of a number of competencies in students. Competencies include attitudes, feelings, values and awareness on their own performance, as well as declarative and procedural knowledge. Competence is related to the management process of applying knowledge in a real situation, in the real tasks, and is usually gained through practice and thinking processes. Some aspects of behaviour in a real situation may depend on the innate qualities of individuals. To the extent to which such behaviour is not learned, it cannot be recognized as learning. Competencies also round out the extent to which an individual accepts his own limitations and based on that consciously plans to overcome them by further learning and training (Cvetković et al. 2015, p. 14).

3. Modern methods in teaching agricultural disciplines

The fact about the importance of modern teaching methods is undeniable. The modern teaching methods (Fig. 2) imply work, which should result in having a student with a creative and critical attitude. They should help the learning process of the students so that it is pleasant, unstressed and entertaining.

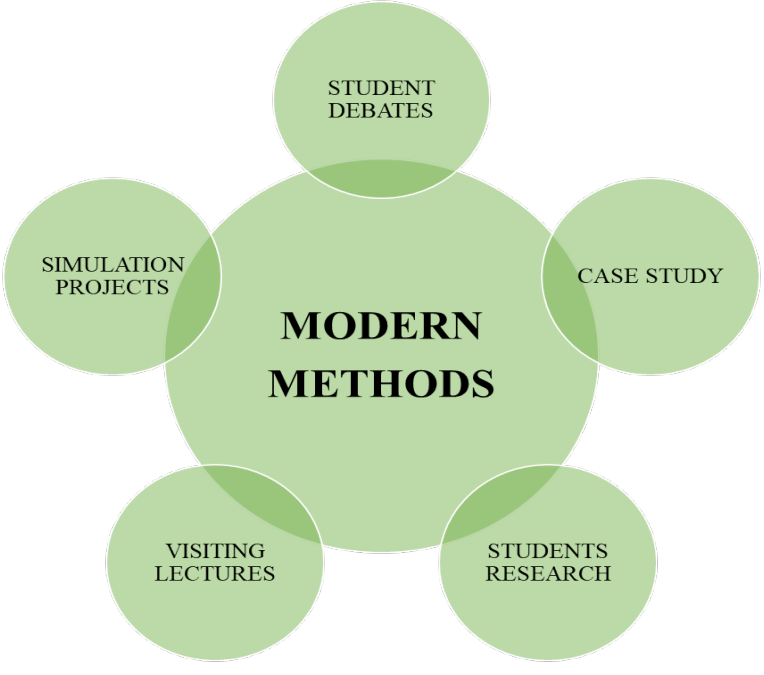

Figure 2. Modern methods of teaching agricultural disciplines

Student debates are a kind of formal discussion in which two opposing groups of students exchange arguments in support of a variety of viewpoints (or theses) on the occasion of a particular subject, respecting the pre-agreed rules. Unlike the usual debate where individuals are free to choose which side to represent, in this kind of debate students are usually assigned the side that has to be presented on a particular topic.

The purpose of application of the student debates as a teaching method is development of communication skills, debating skills and confrontation of arguments, the culture of speech and the ability to rapidly analyse, reasoning and use of expert arguments.

Advantage of the method: the debate as a teaching method increases the involvement and motivation of students to learn, helping them to apply their knowledge in a variety of situations. Debating also leads to improved communication skills, including the development and use of native and foreign language. Participation in the debates gets student in a simulation of real life and business situations in which they need to defend their views and opinions. Debate has positive effect on strengthening the ability of students to work in a synchronized group (Cvetković et al. 2015, p. 48).

Main disadvantage: it takes a lot of time to prepare the students in terms of understanding the rules and the spirit of the debate. Also, the students need more time to gather preliminary material preparation itself and the implementation of debates.

Case study represents a form of active learning of students through finding solutions and answering the question (the case), real or imaginary, which can often have a provocative character. In order to get an answer to the problem and solve the case study properly, the student is forced to ask himself how he would react if he would find himself in such a situation for real, with a detailed description of potential challenges, dangers and possible directions of solutions.

The purpose of application of the case study is reflected in facing students with a situation in which the need to apply the acquired theoretical (and practical) knowledge on the relatively new event that is linked to the processed material. In this way, student develops critical thinking, innovation, the ability to see problems from different angles and in the case of group work develops the ability to work in a group (Cvetković et al. 2015, p. 51).

An advantage of the method is that the student applies theoretical knowledge to the specific case with which he can meet in real life. All students develop the capacity for analytical approach to problem solving, decision-making in a given situation, and dealing with potential ambiguities and overcoming them.

As a disadvantage it can be pointed out there is a real possibility that a student cannot reach enough quality information on the case topic in order to develop a critical attitude on the subject that should be analysed. The students do not have to always have enough theoretical knowledge to visualize the situation from all aspects of importance for the analysis, which may affect the quality of the solutions.

Students research is the active involvement of students in solving certain issues through setting up and implementation of researching the given problem under the supervision of responsible teachers. Through the work on a particular research topic the student analyses the problem, not only theoretically but also practically (Cvetković et al. 2015, p. 55).

The purpose of the student research is the application of theoretical knowledge through practical research and mastering the basic elements of research.

We can list as advantages of this method: (1) the student routinely meets with research techniques that allow him to reach the desired results and conclusions related to the research problem; (2) students develop independence in the planning, preparation and writing of the report, or scientific/professional work; (3) students face real situations in solving the given problem and the application of results; (4) contacts are made with the responsible teacher as part of a team working on a particular issue.

As disadvantages of the method, we can list: (1) it requires a lot of time for successful implementation; (2) adequate workspace is needed (demo, lab or production facility) with adequate equipment.

Visiting (professor) lectures is the method, prepared and presented by the teaching staff of the research institute (or other higher education institutions) intended for students, with the aim to explain in more detail scientific findings on the specific topic or field.

Visiting lectures are intended to convey narrowly specific scientific knowledge and research methods specific for a particular topic. Presentations should affect the development of critical interest and awareness in a particular topic, bearing in mind that the visiting professors are usually highly specialized in the topic or field that he holds the lecture about (or group of lectures).

Advantages: visiting (professor) lectures affect students' better knowledge because they are usually accompanied by contemporary information about developments in the thematic area. At the same time, they enable the exchange of positive experiences with other teachers on a specific topic and contribute to deepening of knowledge. Visiting (professors') lectures speed up development of academic skills to communicate with other teachers (and people at all), which has a special significance for visiting professors abroad.

Disadvantages: lectures by visiting professors are rarely applied as a teaching method due to the difficulty of securing a professor of reference for the specific scientific area. Some disadvantages of this method also include lack of preparation of students for the new teachers and indifference during classes, as well as language barrier when visiting professors present their lectures in foreign (mainly English) language.

Simulation projects (also known as **preparing the projects**) is teaching method through which students are faced with the specific task on finding one or more solutions presented in the form of project documentation.

Purpose of the method: applying preparation of project proposal as teaching method in the agricultural sciences is present in two forms: 1) preparing project proposal of a specific manufacturing process (project proposal for the intensive orchards management, project proposal for poultry farms) and 2) project in the form of implementation of interdisciplinary activities, which aims to demonstrate certain legality (Cvetković et al. 2015, p. 61).

Main advantages of the method are that it allows the students to apply their knowledge. This method enables better understanding of certain thematic areas in which the project is implemented. Also, the project motivates students to learn and work by offering them meaningful activities that are interesting and important to them (they have the ability to choose or independently formulate issues that are interesting and important to them personally).

Disadvantages: implementation of this method requires student's greater engagement than traditional forms of work. This is especially true for independence in work (all activities in preparation of the project proposal are done by students, regardless of whether they are working individually or in pairs), initiative (when

choosing a theme for the project, collecting the material, presenting your answers) decision making (how to choose the topic, how to obtain the relevant materials, how to analyse, how to present the results of the work). Project preparation requires careful definition of themes for the work, so that the projects are in line with the content of the module (Cvetković et al. 2015, p. 62).

Conclusion

Agricultural education teaches students into agriculture, food and natural resources. Empowering children and youth with knowledge and skills through work-based learning in agriculture can be rewarding in terms of entering into jobs, development of small informal-sector businesses, and supporting the transition of students from school to work or higher education.

According to the National Education Policy (NEP) 2020, both capacity and quality of agriculture and allied disciplines must be improved in order to increase agricultural productivity through better skilled graduates and technicians, innovative research, and market-based extension linked to technologies and practices (Mehrotra 2023, p. 88).

The teaching process in agricultural sciences is quite complex, because it requires not only the acquisition of knowledge but the development of specific competencies and skills too, which in the end must also be taken into consideration when evaluating the general knowledge of students (Cvetković et al. 2015, p. 14).

Modern teaching methods provide an opportunity for full-value and quality education in the era of new technologies and artificial intelligence. They need to be designed in a way that the responsible teacher has the possibility to analyse all aspects of the knowledge acquired by the students. This way, the preparation of professionals in agriculture and veterinary sciences through programs, integrated with general education, will be increased sharply. Also, the design of agricultural education will shift towards developing professionals with the ability to understand and use local and traditional knowledge, and emerging technologies while being cognizant of critical issues, such as climate change, declining land productivity etc.

NOTES

1. NORTHEAST AGRICULTURAL EDUCATION FOUNDATION, Inc. *What is Agricultural Education?* Retrieved from: https://www.northeastagriculture.org/agricultural-education-grants/what-is-agricultural-education/.

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