



INTERACTIVE EDUCATIONAL TECHNOLOGIES IN THE TRAINING OF A FUTURE BIOLOGY TEACHER FOR SPECIALIZED SCHOOL

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Abstract.

The relevance of the study is determined by the integration of Ukraine into the European educational system, reforms of secondary education, the transition to specialized education in high school, the growing requirements to vocational training of graduates of higher education institutions, the need to change from the traditional academic style of teaching disciplines to innovation.

The *aim* is to generalize scientific, educational-methodical sources and personal practical experience of using interactive pedagogical techniques in forming the professional competence of the Biology teacher of the specialized school.

Methods used in the research include theoretical (analysis of scientific and pedagogical sources, articles, abstracts, dissertations, Internet resources; synthesis and generalization of factual material; comparison and classification) and empirical methods (pedagogical observation, questioning, interviews with students).

The results. The role of interactive techniques in teacher's training has been analyzed; it is noted that the organization of education on a competence approach is based on strengthening of practical professional orientation of education, development of students' pedagogical abilities and values. The author has implemented the preparation of the future Biology teacher of the specialized school at the second (master's) level of higher education while teaching the course «Theory and Methods of Teaching Biology at the Senior Specialized School». In the course of practical training, group work and interactive learning, which takes place under the condition of the continuous, active interaction of all its participants, are preferred. Moreover, a teacher and a student are equal participants of the educational process. It is mentioned that one of the most effective organizational forms of online learning is training. The author describes at large the methodology of conducting the training «Interactive Techniques of Teaching Biology», which introduces students to training techniques, various innovative methods and techniques of interactive learning, and forms practical skills necessary for their future professional activity.

Anonymous questionnaires of the master-graduates, the future teachers of Biology, Chemistry and the Fundamentals of Human Health have been conducted. The respondents have been asked to rate on a five-point scale the effectiveness of a method, a form, a teaching technique in forming their readiness to work at a specialized school. The analysis of the results of the study is carried out on the basis of the technique of relative frequencies developed by O. Smirnov. Students consider the school practice to be the most effective, while being combined with teacher's mentoring; and they express their preference to have it at specialized classes or educational institutions. The respondents highly appreciate trainings, master classes of experienced teachers, contextual trainings, a creation of their own methodological portfolio and a case study.

Conclusions. Training the modern teacher of the specialized school should be carried out due to the strengthening of the practical component of educational programs. Special attention should be paid to on-the-job (pedagogical) practices in general secondary education institutions with specialized classes. The classroom work with students is effective if the various interactive educational techniques, including trainings, are used; it is promising to involve experienced practicing teachers in the educational process of training future teachers in higher educational institutions.

Keywords: *interactive teaching techniques, training, Biology teacher training, specialized school.*

Introduction. Due to Ukraine's integration into the European educational system, the requirements for vocational training of graduates of higher education institutions are increasing today. The National Agency for Higher Education Quality Assurance established in the country has started the process of educational programs accreditation, based on the principles of trust, mutual demand, culture of quality and integrity. The challenge is to create all the conditions for learning; personal and professional development of students; formation of their professional competence, creativity, as well as social skills namely communication, ability to take responsibility, work in a team, manage their time, think logically and critically, make their own decisions, etc. Requirements for teacher's training have also increased in connection with the secondary education reforms, as well as the transition to specialized education in the high school, as reflected in the Conceptual Framework for Secondary School Reform: The New Ukrainian School. Currently the higher education institutions face the challenge whether they are able to move from the traditional academic style of teaching to innovation, from the focus on knowledge, skills and competencies to the formation of competencies.

The analysis of scientific-pedagogical sources, personal pedagogical experience of working in the higher educational institution and the school, as well as interviews with higher education applicants indicate that the most effective methods and techniques of forming the future teacher's professional competence are interactive educational techniques (trainings, group methods, discussions, debates, business and didactic games, etc.); case study or a case analysis method; a portfolio; information and communication technologies, contextual and dual learning. In our opinion, interactive teaching in the context of future teacher's preparation is the basic educational technique.

Sources. Recently the content, ways, methods and techniques of training the Biology teacher of the specialized school have become the subject of fundamental scientific research. Thus, N. Shyian's (2015) scientific research is devoted to the theory and practice of specialized education in rural schools (for example, the study of Chemistry and partly Biology). V. Onipko's (2011) monograph substantiates the methodological, theoretical and organizational principles of preparing a Natural Science teacher to work in the specialized school; in particular to the implementation of the biotechnological profile of training. H. Hritsai's (2016) studies cover the field of methodological training of a future Biology teacher, and Y. Shapran's research works (2013) are related to their professional competence. Our scientific research is also aimed at finding effective ways and techniques

of forming specialized profile-oriented competence of the Biology teacher, which continuously takes place at the bachelor's and master's levels of higher education and continues in the system of postgraduate pedagogical education (Melnychenko, 2019).

In the last decade, interactive educational techniques and teaching methods have been increasingly implemented in the higher education (Kashlev, 2005; Piatakova, 2008) and adult education (Sysoieva, 2011). The authority in the field of interactive learning is O. Pometun (Pometun and Pyrozhenko, 2002; Pometun, 2007), whose scientific and methodological achievements are used by the secondary and high schoolteachers. Many useful methodological developments, interesting examples of interactive techniques, case studies, techniques of development of critical thinking used by experienced practicing teachers can be found on the educational platform "To the Lesson" (<https://naurok.com.ua/>). However, the problem of training Biology teachers to the work in the specialized school remains relevant and requires finding new ways to solve it, including with help of interactive educational techniques.

The aim of the article is to summarize scientific, educational and methodological sources and personal practical experience of using interactive pedagogical techniques in forming the professional competence of the Biology teacher of the specialized school.

Research methods: theoretical (analysis of scientific and pedagogical sources, articles, abstracts, dissertations, Internet resources; synthesis and generalization of factual material; comparison and classification) and empirical methods (pedagogical observation, questionnaires, interviews with higher education applicants)

Results and discussion. The content of the professional training of the Biology teacher of the specialized school is implemented in the higher educational institutions at the bachelor and master's levels of higher education and is continued in the system of postgraduate pedagogical education. The main purpose of such training is the formation of professional competence of the Biology teacher of the specialized school, that helps them successfully carry out daily professional activity in the conditions of the profile training. The education process organization within a competence approach is based not only on the basic knowledge and skills, but also on strengthening the practical professional orientation of teaching, the development of pedagogical abilities and values of the future teacher.

We have implemented such training at the second (master's) level of higher education while teaching the author's course "Theory and Methods of Teaching Biology in the Senior Specialized School" higher

education applicants, program subject area 014.05 “Secondary Education (Biology and Human Health)” 3.5 ECTS credits in Zhytomyr Ivan Franko State University.

In the textbook, O. Pometun (2007, pp. 221) cites data, obtained by American researchers, on the effectiveness of various forms of learning. According to the so-called “student learning pyramid”, the effectiveness of learning when using different forms and methods is different, namely: a lecture-monologue – 5%; independent reading – 10; the use of audio and video training – 20; a demonstration – 30; a discussion of the educational material in a small group – 50; a practice in the process of activity – 75; teaching others – 90%. That is why practical training organized with the usage of the interactive educational techniques is of a great importance while training the future teacher.

During the practical classes of the course “Theory and Methods of Teaching Biology in the Senior Specialized School” we use well-known pedagogical techniques (module, problem, game, interactive, project, training teaching). Students are grouped into micro-groups and do some individual and group tasks. The teacher controls their activities, consults, coordinates, corrects the work of future teachers, if necessary the teacher helps, answers questions, and promotes reflection of their activities. As recommended by S. Vitvytska (2009, pp. 146-147), the group work of undergraduates is organized according to a certain algorithm:

- setting a specific cognitive task, creating a problem situation, providing a case for analysis, etc.;
- dividing students into micro groups of 2-6 people;
- briefing on the content, the sequence and results of the work;
- working in groups (distribution of tasks between group members; individual performance of them; announcement of individual work results in the group; discussion of the overall group task, its generalization and supplementation by individual members; roles distribution for announcement of the group work results);
- final part: communication of the work results, reflection, conclusion about the work of the group and the success of the task.

In the practical classes on “Theories and Methods of Teaching Biology in the Senior Specialized School” we offer students tasks of different levels. For instance, *reproductive-level* tasks include analyzing the structure of a school program in Biology and Ecology, integrated science courses and elective courses; description of school textbooks; selection of control tasks for a specific topic; compilation of the necessary “professional minimum” in the Biological disciplines

that is the basis of the school course in Biology (tasks of the External independent testing in Biology; test assignments on different topics of the school course in Biology in high school); filling the register; drawing up a plan for a school lecture and / or a seminar; selection of questionnaires to determine students’ professional aptitudes and interests, as well as their psychophysiological characteristics; compilation of a bibliography of scientific and educational-methodical literature for work on a certain psychological-pedagogical or methodical research, etc.

The *assignments* of the *constructive level* include preparation of abstracts and multimedia presentations; selection of Biology textbooks for 10th and 11th grades on a competitive basis with argumentation; drawing up a synopsis of classes; tasks of final and current control of a certain educational topic for classes of different profiles and directions of study (chemical-biological, philological, mathematical); developing creative tasks for work with gifted students (Olympics tasks, high in complexity tasks, the international PISA program tasks); drawing up a plan for the research, social and information projects in Biology; visualization of educational material of various Biological topics (creation of reference schemes, tables, intelligence cards, flash cards, didactic cards, etc.); preparation of issues and questions of a problematic nature in the methodology of teaching Biology and the school course in Biology. Constructive level assignments are dominant in working with undergraduates.

The *creative level assignments* are offered to undergraduates with sufficient and high level of professional knowledge and methodological skills and expressed intrinsic motivation for professional activity. This types of tasks includes, for example, conducting a lesson and drawing a supporting syllabus to it; writing a conference report or an article in a collection or a journal; a speech at a scientific and practical conference of students and young scientists; development of a detailed organizational plan for Biology Week; methodical games development on different school Biology course topics taking into account the class specialization; drawing up a plan of the research work in Biology within the framework of the Junior Academy of Sciences and other.

As mentioned above, *interactive training* is preferred during laboratory and practical classes. The word “interactive” comes from English “interact”, where “inter” means mutual and “act” – do something. Most scholars (Kashlev, 2005; Pometun, 2007; Piatkova, 2008) emphasize that learning is thought to be interactive when the educational process takes place under the condition of continuous, active interaction of all its participants; an educator and a student (a student, a teacher in the process of upgrading peda-

gological qualification, etc.) are equal participants of the educational process. Due to these activities, the atmosphere of interaction and cooperation is created in the classroom. Students learn to think critically, make their own well-thought-out decisions, participate in discussions, and communicate with others. Interactive learning is a special form of a cognitive activity organization that creates comfortable learning conditions, when everyone feels their success, intellectual abilities.

Belarusian teacher S. Kashlev (2005, pp. 31) emphasizes that interactive learning is a process of the interpersonal communication, characterized by a high degree of intensity of the communication, variety of types, forms and techniques of activities, a purposeful reflection and a mutual influence. Its essence is to reveal the creative potential of students in the conditions of the free and productive brain activity, the creative atmosphere of the interaction between the teacher and students.

There are different approaches or criteria for classifying interactive teaching methods. We use the classification developed by O. Pometun and L. Pyrozhenko (2002), who, depending on the purpose of employment and the form of the educational activity organization, distinguish four groups of interactive learning techniques. We offer the specific methods for each group:

1) interactive cooperative learning techniques (working in pairs, rotary triples, small groups, O. Rivin's theme transfer method, E. Mazur's mutual learning method, "carousel", "aquarium", etc.);

2) interactive techniques of cooperative group learning ("microphone", "snow ball", unfinished sentences, Bloom's cube, "brainstorming", "circle of ideas", "openwork file", "Brownian motion");

3) situational modeling techniques (imitation and role-playing games, simulation, analysis of life situations, case studies, dramatization, etc.);

4) discussion questions techniques (PRESS method, SWOT-analysis, take a stand, discussion, "six hats" by E. de Bono).

We work out these local interactive pedagogical techniques in the practical classes of the course "Theory and Methods of Teaching Biology in the Senior Specialized School". For the efficiency of work at the beginning of studying the course (paired lesson №3-4) we conduct 2-3-hour training "Interactive Techniques of Teaching Biology". First of all its purpose is to introduce students to a training technique, as well as various methods of interactive learning, to form practical skills of their use in the future professional activity.

Training is one of the most effective organizational forms of online learning. The word "training" comes

from the English "to train" – "to teach, to develop and to improve". Training appeared as a method of the psychotherapeutic work in the 19th century, and subsequently spread in the vocational education and psychology as an effective technique for the personal development and then was applied in institutions of higher and secondary education. Training is proved to contribute to the intensity of learning, the result of which is achieved through the active work of its participants. Knowledge is not presented in a ready form, but becomes a product of the active cooperation of the participants. The focus is on participants' self-study and intensive interaction. Training is considered, on the one hand, to be an active organizational form of educational work, which relies on the experience and knowledge of participants, active practical pedagogical and psychological methods. On the other hand, training is the interactive learning technique with a distinct structure and attributes that is well reproduced and guarantees high quality of the educational process and the achievement of practical results.

Training is based on well-established common principles such as the activity, the open feedback, the experimentation and the creativity, trust in the communication, the equality of positions. The aim of training is to improve its participants' life and professional skills, competences, to find ways to solve specific problems ect. That is why training is a leading form of the teaching process organization while studying Fundamentals of Human Health, is expedient in the study of Biology and Ecology, which are the main subjects in the formation process of key competences in Natural Sciences and Technologies, Environmental Literacy and Healthy Living (Melnychenko, Polishchuk, 2019).

We believe that while studying at the higher educational institutions students should participate in various trainings, mastering this technique from the inside out as participants. In studying the teaching methods of these subjects, the future Biology teachers conduct trainings during practical classes in the modeling class, as well as during the pedagogical practice.

Attributes of the training are: 1) a training group (10-15 persons involved by active coaching in the active communication and solving tasks); 2) a coach – a person who is an equal participant of the training group and, at the same time, a trainer who has knowledge of the topic of training and the skills of conducting training sessions; 3) a specially equipped room and equipment (chairs arranged in a circle or a semicircle, some space for movement, markers, a magnetic board, handouts, paper, etc.); 4) the rules of the group, which are clearly announced at the beginning of the training, observed by the participants

and provide comfortable conditions for training (Melnychenko, Polishchuk, 2019).

The structure and objectives of the training undergraduates of the speciality 014.05 “Secondary Education (Biology and Human Health)” are demonstrated in *table 1*.

The main part of the training is the most important and can include a variety of topics such as project activities, ICT training technologies, the development of critical thinking in Biology lessons, health-saving technologies, the formation of environmental culture, etc. It is the skill of the trainer-teacher that determines

its filling and effectiveness of trainings. It is advisable to use the training form of work to improve the professional skills of teachers.

In order to determine the effectiveness of the use of certain educational techniques and methods while training the Biology teacher of the specialized school, we have conducted an anonymous survey of master-graduates, future teachers of Biology, Chemistry and Fundamentals of Health of Zhytomyr Ivan Franko State University. The respondents (48 students) were asked to evaluate the effectiveness of one or another method (form, technique) on a five-

Table 1.

The structure of the author's training “Interactive Techniques of Teaching Biology” for future Biology teachers of specialized school

Training stage, Duration	Assignments and exercises
I. Introduction (up to 15 min)	<p><i>Brainstorming</i>: The question is “What is Training – a Form, a Method or a Technique?” A report is about required attributes and a training structure.</p> <p>A) “<i>Acquaintance</i>” (1-2 exercises: “snow ball” – the first participant says his/her name and something he/she loves; the next one repeats the name and preferences of the first one and then names his/hers, etc.; “Acrosword” – participants write their names in a column on a piece of paper, opposite each letter they write a word that characterizes them, they attach the pieces of paper to their clothes as a name badge).</p> <p>B) <i>Adoption of training rules</i>. The rules can be written on a board, paper, drawn on pieces of paper that are alternately read, received and attached (for example, time appreciation, courtesy, address by the name, the rule of the raised hand, the rule of voluntariness, etc.).</p> <p>C) <i>Expectations</i>. Participants write down their expectations from the training and depict them graphically (for instance, “boats” and two river banks – hopes and accomplishments, “mushrooms” near the basket, etc.).</p>
II. Main part 1.5 – 2 hours	<p>A) <i>Grouping</i> (according to geometric shapes, a colour, seasons, an active exercise “molecule and atoms”, etc.), communication exercises.</p> <p>B) <i>Group and individual work</i>. Students are offered a number of interactive techniques for working out methodical skills:</p> <ul style="list-style-type: none"> – work on cases (certain problematic life situations written on a piece of paper that require collective discussion and solution); – exercises such as “Yes / No”, “Take a position”, “Border”; – Bloom’s Cube of Thinking / Bloom’s Taxonomy Questions (asking questions from a lower to a higher level of difficulty to encourage students to develop critical thinking); – “Brownian Movement” / “Carousel” / “Learning while Training” exercises (everyone receives printed information about an interactive teaching method, moves freely, trying to tell others and memorizing new information themselves); – exercises to visualize information. The groups depict graphically obtained information from a course in Biology and Ecology (or methods of teaching them) in different ways – they make up a word cloud, an intellect map, a fish-bonn, a reference block diagram, a spidergram; – exercises for the development of critical thinking: the Six Hats method by E. Bono; SWOT – analysis of phenomena, factors (S – strengths, W -weaknesses, O – opportunities, T – threats); – training practice. The representative of each group, using supplements, conducts some stage of training: grouping, acquaintance, expectations, movements, reflection, completion. <p>C) <i>Exercises to relieve muscle and mental strain</i> alternate with group work. These are various active exercises (“Australian rain”)</p>
III. Completion (15-20 min)	<p>A) <i>Reflection exercises</i> (“microphone” method; analysis of own expectations at the beginning of the training; writing a cinquain).</p> <p>B) <i>The results are summarized</i> by the trainer.</p> <p>C) <i>Completion of the training</i>: “Wreath of Wishes”, “We are good fellows!”</p>

point scale (from 1 – absolutely ineffective, to 5 – the best, ideal) while forming their readiness to work in the specialized school.

An analysis of the study results on the basis of the relative frequencies technique by O. Smirnov (1990) is presented in *Fig. 1*.

Therefore, undergraduates think that the most effective for their readiness to work in the specialized school is a practice at the general secondary education institutions, which is combined with a teacher's guidance (0.91). The students mention that they would like to take it at specialized educational institutions or classes. In addition to this the respondents highly rate trainings, master classes of experienced teachers (0.85 and 0.81 respectively). They also positively rate

contextual learning (0.73), creation of own methodical portfolio and a case technique (0.68).

Conclusions. The training of the modern teacher of the specialized school should be carried out with the strengthening of the practical component of educational programs. Particular attention should be paid to the on-the-job (pedagogical) practices in the general secondary education institutions with specialized classes. Classroom work with students is effective due to the use of a variety of interactive educational techniques, including trainings. It is promising to involve experienced teachers in the educational process of training future teachers in the higher educational institutions.

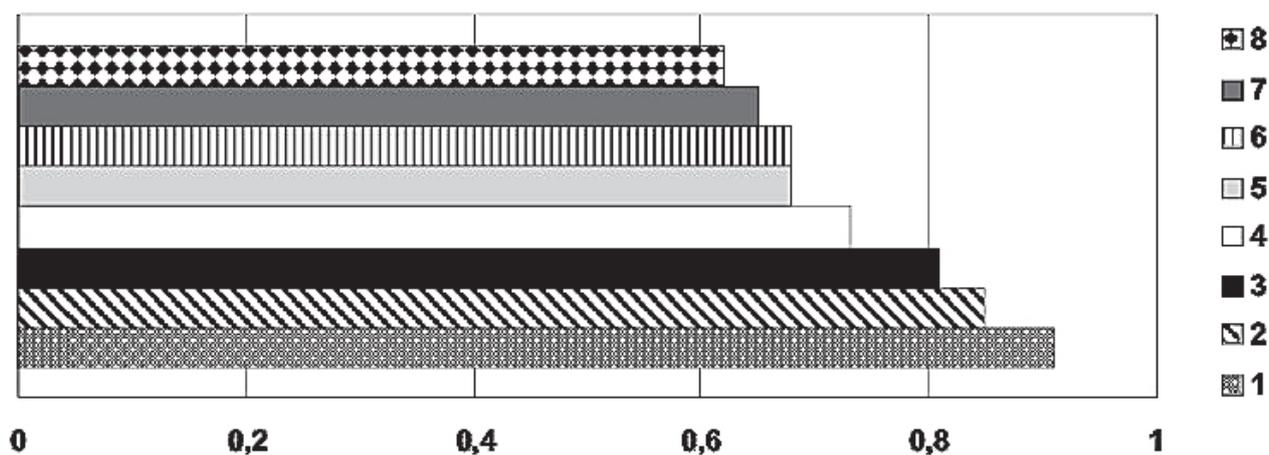


Fig. 1. Effectiveness of application of certain forms, methods and techniques in the training of a Biology teacher of a specialized school (according to the data of students' self-assessment):

- 1 – on-the-job practice in a school, teacher's mentoring; 2 – methodological trainings; 3 – master classes from practicing teachers; 4 – contextual learning (conducting lessons and their fragments at university classes); 5 – a personal methodical portfolio creation, 6 – a case study (a method of modeling life situations); 7 – multimedia lectures with the demonstration of lessons video clips; 8 – seminars.

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Інтерактивні освітні технології у підготовці майбутніх учителів біології профільної школи

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Актуальність дослідження зумовлена інтеграцією України в європейський освітній простір, реформою середньої освіти, переходом до профільного навчання у старшій школі, зростанням вимог до професійної підготовки випускників закладів вищої освіти, потребою переходу від традиційного академічного стилю викладання дисциплін до інновацій.

Мета: узагальнення наукових, навчально-методичних джерел і власного практичного досвіду застосування інтерактивних педагогічних технологій при формуванні професійної компетентності вчителів біології профільної школи.

Методи: теоретичні (аналіз науково-педагогічних джерел, статей, авторефератів, дисертацій, інтернет-ресурсів; синтез та узагальнення фактичного матеріалу; порівняння і класифікація) та емпіричні методи (педагогічне спостереження, анкетування, інтерв'ю зі здобувачами вищої освіти).

Результати: проаналізовано роль інтерактивних технологій у підготовці вчителів; зазначено, що організація освіти на компетентнісному підході базується на посиленні практичної професійної спрямованості навчання, розвитку педагогічних здібностей і ціннісних орієнтирів студентів. Автором реалізовано підготовку майбутніх учителів біології профільної школи на другому (магістерському) рівні вищої освіти під час викладання курсу "Теорія і методика викладання біології у старшій профільній школі". При проведенні практичних занять перевага надавалась груповій роботі й інтерактивному навчання, що відбувається за умови постійної активної взаємодії всіх його учасників, а педагог і студент є рівноправними і рівнозначними суб'єктами освітнього процесу. Зазначено, що однією з найефективніших організаційних форм інтерактивного навчання є тренінг. Автором детально описано методику проведення тренінгу "Інтерактивні технології навчання біології", що знайомить студентів із тренінговою технологією, різноманітними інноваційними методиками і прийомами інтерактивного навчання, формує практичні навички їх застосування у майбутній професійній діяльності. Здійснено анонімне анкетування магістрів випускних курсів, майбутніх учителів біології, хімії та основ здоров'я. Респондентам пропонувалося оцінити за п'ятибальною шкалою ефективність того чи іншого методу, форми, освітньої технології у формуванні їхньої готовності до роботи у профільній школі. Аналіз результатів дослідження здійснювався на основі методики відносних частот О. Смірнова. З'ясовано, що студенти найбільш ефективною вважають практику в школах, котра поєднується з наставництвом учителя; висловлюють бажання проходити її у профільних класах чи навчальних закладах; високу оцінку респондентів отримали тренінги, майстер-класи від досвідчених вчителів, контекстне навчання, створення власного методичного портфоліо і кейс-навчання.

Висновки: підготовка сучасного вчителя профільної школи повинна здійснюватися з посиленням практичної складової освітніх програм; особливу увагу варто приділити виробничим (педагогічним) практикам у закладах загальної середньої освіти, що мають профільні класи; аудиторна робота зі студентами є ефективною за умови використання різноманітних інтерактивних освітніх технологій, у тому числі тренінгів; перспективним є залучення досвідчених педагогів-практиків до освітнього процесу підготовки майбутніх учителів у ЗВО.

Ключові слова: *інтерактивні освітні технології, тренінг, підготовка вчителів біології, профільна школа.*

Received: 14 September 2019

Accept: 04 November 2019