

ВИЩА ОСБІТА**HIGHER EDUCATION**

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V.V. Liubchenko, Dr.Eng., Assoc.Prof.
Odessa National Polytechnic University**BLENDED LEARNING MODELS FOR DIRECTING
THE SELF-LEARNING ACTIVITY OF “SOFTWARE
ENGINEERING” SPECIALTY STUDENTS**

Introduction. The Law of Ukraine “On Higher Education” effective from September 2014 binds over the educational institutions a requirement to reduce both students workload (reduction factor: 1,2 i.e. from 36 to 30 hours per credit) and teachers workload (reduction factor: of 1,5: from 900 to 600 hours). At that recommended is to retain the teaching staff listing table unchanged. Thus, reduction in teachers’ load involves reducing the in-classroom hours at both bachelor’s and master’s curricula. Consecutively, due to such schedules’ shifting, increases the amount of theoretical material and practical works assigned to independently studied program part. Meanwhile none changes should take place in the list of instrumental, general scientific and professional competencies acquired or in the system of skills, ensuring these competencies availability. Therefore, increased is the importance of addressing issues in students’ self-learning quality maintaining that is determined by the level of knowledge, competences and practical skills acquisition by students through extracurricular work and respective knowledge and skills compliance with the higher education standard.

Literature review. Since Ya. Comenius’ time the classical pedagogy principles and methods remain focused mainly on satisfying the industrial society needs. At nowadays information society, many of these methods become irresponsive to actual society needs, with a surging rate of information exchange, and thus the decision-making speed, due to the dynamics of economic, cultural and political phenomena [1]. This problem is particularly acute in the educational process concerning such a rapidly changing knowledge field as “Computer Science and Engineering” when training bachelors and masters specialized in “Software Engineering”. Inter alia, evidently obsolete and therefore outdated is the principle of academic disciplines structure and educational process organization forms stability, focused onto in-class activities, and scheduling the self-learning/independent studies only as acknowledging with information sources that makes this work [2]:

— enervative — instead of creating conditions for the acquisition of expertise, knowledge and skills such activity discourages interfering with the learning process;

— endless — boring repetitions, passivity and lack of interaction allow students to “drop out” of the learning process, thus not acquiring the desired skills;

— empty — at the absence of active educational strategies necessary for the learning process effective implementation.

As a result, students prefer the specialized courses offered by companies, software developers, or work on their own projects to performing tasks for independent work. This greatly complicates the

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process of forming the skills, which list and required level are determined by the higher education standard.

In this regard, actual becomes the problem of students' independent learning activity organization that would attract students' attention and improve their self-learning results quality. It seems appropriate to use blended learning methods for this goal reaching.

The blended learning represents a purposive dedicated process of acquiring expertise, knowledge and skills through the integration of in-class and extracurricular learning activities of educational process subjects with the auxiliary of mutually complementary traditional, e-learning, distance courses and mobile learning technologies under condition when learning activities' time, place, path and pace are self-controlled by the student [3].

It is customary to discern the three blended learning components: in-class personal interaction, interactive communication using information and communication technologies (ICT) and self-learning as independent studying activity [4].

The blended learning pedagogical specificity refers to such features [5]:

— Unrestricted content, as due to the use of ICT the course content is not limited to information materials, prepared by teachers, but may include any resources related to subject topic and available on the Internet;

— Regard to the educational needs as the ICT tools enable both to provide individual learning paths and to support various forms of interactivity, including individual counseling, group work and so on;

— Switching the teacher's position from the vertical dominance role into the horizontal interaction;

— Enabled possibility to use not only the external evaluation, but also mutual and self-evaluation tools.

It should be noted that these principles are consistent with the person-centered approach principles in education [6]. In addition, ICT used at the learning process represent a natural environment for students in "Software Engineering" field that increases comfort feeling when independent tasks working out.

This research objective relates to forming the students' self-learning activity arrangement (that will contribute to results quality), scenario based on blended learning models.

Main Body. The blended learning is essentially focused on extracurricular studies activity. Therefore, we can assert that the educational process organization models developed in its framework represent a natural tool for increasing the students' self-learning productivity. Below we shall consider the basic models.

1. *The rotation model* departs from the principle that the assigned curriculum following, either while a particular subject studying, students (on the approved schedule basis or at the teacher's discretion) do alternate forms of work with the material, using as well the ICT tools. Other alternating in the rotary models forms of work with the material are: study group in-class work to solve a specific problem, in-class team work, team projects, individual lessons and written assignments. Usually the rotational model is divided into 4 submodels.

1.1. *The rotation model including online stages*, where students alternate learning activities upon a fixed schedule, and the process of material assimilation comprises at least one online learning stage. In this model, students must follow all stages, both in-class and online ones.

This rotational sub-model is often used, still without ICT component. For example, a laboratory practicum traditionally includes 4 stages: preliminary self-training, in-class laboratory research properly said, report formalization at home and the research report defense. The majority of students do ignore the preliminary self-training stage either they do very poorly prepare to the next in-class activity. The situation can be improved through introducing such tool as "Lectures with self-examination", provided with Learning Management System (LMS). This tool allows, firstly, to control time spent by the student when preparing stage, and, secondly, to direct the self-training process preventing the student from opportunities to ignore the unassimilated material. If we take into account the mark resulting from the student's self-examination, therefore eliminated is the need for quizzing at the lesson's beginning so we can redirect in-class activities' time to work out specific applied tasks.

Worth to mention is that both report formalization at home and the research report defense can also be transferred to the LMS. For that purpose we can provide students with a report template to fill in with subsequent download of ready report accompanied by research conclusion summarizing text using the LMS tool "Tasks". Firstly, this allows monitoring the report delivery timeliness and, second-

ly, that eliminates the need of teacher-to-student personal meetings to examine reports. The only case of in-class time allotted to reports' defense here refers to the students, whose reports did not allow a clearly assessment of their laboratory research issues.

1.2. *The rotation model including laboratory research* involves the alternation between in-class activities (interacting with the teacher) and assignments for independent work in the computer lab, within the practice-oriented online learning frame. This model differs from the previous one as the students can work in different locations within the institution that allows increasing the work efficiency in the absence of opportunities to ensure all of studying group's students with equipment necessary to perform the scheduled activity.

For example, at programming studies, in-class activities under teacher's supervision may be dedicated to a specific task in-group solving, after that students are independently working out a similar problem, when necessary getting an online advice. This solution can significantly reduce the in-class time maintaining the possibility to consult and control the process of students' self-performance.

Another typical example: scheduled is a laboratory practicum requiring special equipment use, but it is not possible to provide whole group's access to the equipment. When providing access to the equipment at students' spare time is possible, implementing the labs rotational model will furnish to each student (or team of students) an opportunity to perform the needed research at the expense of independent work time. At that the guide/manual on laboratory work routine may be available online as an interactive instruction, electronic textbook or any other form of teaching aids presentation.

1.3. *The anticipatory learning model*: at this model the typical sequence of lectures and practical tasks is reversed. At home students watch short video lectures, and in class they have the time to perform practical tasks, implement projects, discussions and debates. This model special value is due to the possibility to use class time for group sessions when students can discuss the lecture content, test their knowledge and interact with each other in practice. In addition, the video lectures help to explain the material difficult for explaining at standard lectures.

The anticipatory learning model is most useful in situations where there is a possibility to shift lectures, dedicated to specific methods of work and problems solving at the self-learning time. In this case, LMS used, we can verify whether the student was prepared to engage in, and how much time he spent on the preparation, i.e., LMS contribute to ensuring that students come to the classroom trained to perform practical tasks, therefore allowing in-class time scheduling to perfect skills acquired. For example, studying FPA method of software size estimating during the lecture, it is impossible to completely explain how to use this method, due to the fact that 6 different reference tables shall be used at such assessment. Using the advanced learning model, we can provide students for self-training with a video lecture or slide presentation, outlining the general sequence of method applied and explaining how to operate different reference tables. In this case, LMS serves in tool for controlling the student's readiness to a lesson. In-class time therefore is devoted to solving a specific problem of software size estimating that allows applying this knowledge in practice having studied all the issues involved.

1.4. *The individual rotation model* supposes that each student follows an individual schedule of subject studies and the online stage availability is prerequisite here. This model peculiarity is that students do not necessarily go through all the stages of material working out, as in the case of "stations" model.

E.g., for students having to refill an inter-/intra-curricular difference (due to discrepancy between previous and new syllabuses or resulting from a missed assignment), it is possible to arrange a special schedule specifying the path they work with the material: online study, self-learning, consultation with the teacher and studied subject checkpoints control. This allows rendering the independent work on academic differences' elimination more organized and controllable with the use of LMS tools for students' activity monitoring as well as specially selected assessment tools (self-examination tools, tests, assignments). In this case, the in-class activities directed by teacher will be needed only for mid-semester control examinations. Another example of naturally sound use of individual rotation model is this one of assistance and supervision in various types of students' individual work (calculation and graphic tasks completing, course and diploma projects) integral to the learning process. The individual rotation model allows to organize such individual missions' "rhythmic" performance. The teacher assigns such tasks' control milestones, evenly distributed over time (recommended duration is from 2 to 4 weeks) and ending with some result tangible in terms of achieving the common goal. With the LMS

auxiliary the process schedule is assigned and the task implementation is monitored. Time intervals, assigned for in-class consultations are therefore free for discussing problems encountered in the next stage implementation and for agreeing the work's next phase vision.

2. *The flex-model* is mostly aimed at developing students' self-learning skills involving at practice the specially selected tasks that meet every student's level and characteristics, in such way the students can structure their self-learning, interrupting when a need in consulting with the teacher or other students, in some recreation either other forms of activity arises. Also practicable are such in-class activity options as work in small groups, group projects and individual training. Here convenient is engaging certified online consultants providing daily online consultation, while other teachers can focus onto in-class audience support.

It should be noted that this model is more suitable for directing the part-time students' training. For example, a student may be granted online access to curriculum and study instructions. In addition, the University provides the online consultants service on the studied programs. And while the introductory sessions, the teachers can use in-class time for analyzing the most interesting and complex topics.

At full-time studies the flexible model is most useful when directing learning activities of graduate students combining their university studies and employment. In this case, students get online access to educational materials and programs for a given semester as well as to schedules of full-time classes, and teachers at the semester beginning do clearly define in-class the blended learning rules and scheme. The students get an opportunity to study on a flexible schedule choosing the mode (full-time or online) to study special courses' topics. For example, they are provided with a complete set of slides used in lectures, allowing them to decide whenever going to a lecture or dealing with a topic independently. Apart that the flexible model has a more specific embodiment through the use of special ICT tools for directing the distributed learning activities. For example, the traditional laboratory works on software agile- development are replaced by teamwork onto Assembla.com platform at the self-learning time expense. Thus the in-class time is used only to demonstrate the obtained intermediate results and to coordinate tasks for the development next iteration.

3. *The self-blend model* assumes that students choose to study some additional online courses as option. Students can study these courses not only in, but also outside the educational institution. So recently very popular in the programmers' community become the Massive Open Online Courses (MOOC), offered by such famous universities as Stanford and Harvard University, Massachusetts and California Technical Institutes, Universities of London and Melbourne, École Polytechnique Fédérale de Lausanne and others.

Meanwhile that this model full use still not possible in the current environment, the option of MOOC used as a means of students' self-learning directing (in the same closely related subject) is acceptable. E.g., the theoretical course "Algorithms and Data Structures", exposing basic concepts of the algorithms theory and most used algorithms has its natural complement, namely the Stanford University's MOOC "Algorithms: Design and Analysis", dealing with the basic techniques of algorithm design. This solution provides several additional advantages, i.e.: students get the opportunity to practice learning in a foreign language and acknowledge with the teaching methods of the world leading educational institutions. Additionally, when interviewed by the software development company's hiring manager, a graduate benefits from such courses' successful study.

4. *The online driver model* represents this one when the students are independently distributing their studies time between classroom and distance learning. This model difference from anticipating training one is that students do not attend the school every day. Its distinct from the self-blend model refers to that it is not just a learning method, but the entire school operation model. Under current conditions this model use is available only for part-time students.

Summarizing results of the considered blended learning models' nature and implementation analysis we can conclude that the blended learning models use really allows to increase the productivity of students' self-learning time by improving its organization and accountability. However, not all models can be used in full-time education process. When selecting a model we should be guided by the purposes of its planned application.

Results. The overall scenario of blended learning models use would be following:

- Specifying the discipline objectives and tasks to be solved during the students' independent work;
- Choosing the most appropriate model for solving each of the tasks identified at the previous stage;

— Developing training aids and materials for online use, designing the structure of educational interaction at self-learning process (both between students and between students and teachers), elaborating the student's work plan and its monitoring tools;

— Implementing the selected models' online elements using the LMS, the school's blog, website or other ICT tools;

— Preparing clear instructions and methodical tutorials for students' scheduled self-learning tasks fulfillment;

— Starting the teaching process with blended learning models integrated.

Teaching staff should be ready to introduce some adjustments to the materials prepared for the semester not only at the end of the subject studying, but also "on the fly". However, with the use of ICT tools, such amendments implementing in a timely manner is not difficult.

Conclusions. No doubt, the blended learning models' use represents a certain challenge due to their specific introduction into the educational process. First of all, it should be understood that each model use to a greater or lesser extent, requires changes in traditional teaching and learning materials and methods of teaching, with respect to the fact that in an environment where the distance to overcome for any information getting makes only one mouse-click, the competition for students will be very acute. Apart that, in the present conditions the students' most important skills become the ability to think critically and to critically analyze the available information, i.e. the issues currently not yet sufficiently addressed.

Essential is to pay attention to the fact that the university educational process does impose and require the teaching staff's expertise in e-learning technologies. The current students' generation feel themselves freely in the online environment. Therefore it is very important to use that environment opportunities.

In such a way, using the independent studies directing scenario on the basis of blended learning models allows not only to make this work more organized through elaborating clear schedules and better control of scheduled tasks execution, but we obtain a reliable tool of monitoring due to the possibility of monitoring both progress and success of the independent task implementation using means and techniques that ensure the individually-tailored learning schemes.

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АНОТАЦІЯ / АННОТАЦИЯ / ABSTRACT

В.В. Любченко. Моделі комбінованого навчання для організації самостійної навчальної роботи студентів напрямку “Програмна інженерія”. Одним із наслідків прийняття в 2014 році Закону України “Про вищу освіту” є збільшення частки самостійної роботи студентів у навчальних планах. У зв’язку з цим є актуальною задача організації самостійної роботи студентів, яка сприяє підвищенню її якості. Мета роботи — сформулювати сценарій організації якісної самостійної роботи студентів на основі моделей комбінованого навчання. У статті проаналізовані чотири моделі комбінованого навчання: ротаційна, гнучка, самостійно визначена і віртуально збагачена — та наведено приклади їх використання. Показано, що для очних студентів найбільш прийнятними є перші дві моделі. Сформульований загальний сценарій використання моделей комбінованого навчання. Зроблено висновок, що хоча застосування моделей комбінованого навчання призводить до виникнення ряду труднощів, воно також забезпечує контрольованість самостійної роботи студентів.

Ключові слова: комбіноване навчання, ротаційна модель, гнучка модель, самостійно визначена модель, віртуально збагачена модель.

В.В. Любченко. Модели комбинированного обучения для организации самостоятельной учебной работы студентов направления “Програмная инженерия”. Одним из следствий принятия в 2014 году Закона Украины “О высшем образовании” является увеличение доли самостоятельной работы студентов в учебных планах. В связи с этим актуальной является задача организации самостоятельной работы студентов, повышающей ее качество. Цель работы — сформулировать сценарий организации качественной самостоятельной работы студентов на основе моделей комбинированного обучения. В статье проанализированы 4 модели комбинированного обучения: ротационная, гибкая, самостоятельно определенная и виртуально обогащенная — и приведены примеры их использования. Показано, что для очных студентов наиболее подходящими являются первые две модели. Сформулирован общий сценарий использования моделей комбинированного обучения. Сделан вывод, что хотя применение моделей комбинированного обучения приводит к возникновению ряда трудностей, оно также обеспечивает контролируемость самостоятельной работы студентов.

Ключевые слова: комбинированное обучение, ротационная модель, гибкая модель, самостоятельно определенная модель, виртуально обогащенная модель.

V.V. Liubchenko. Blended learning models for directing the self-learning activity of “Software Engineering” specialty students. The adoption of Law of Ukraine “On Higher Education” (2014) involves the increase in students’ self-learning activity part in the curriculum. Therefore the self-learning activities’ arrangement in a way augmenting the result quality becomes a top priority task. This research objective consists in elaborating the scenario for organization of the students’ qualitative self-study, based on blended learning models. The author analyzes four blended learning models: the rotation model, flex-model, self-blend model and online driver model, and gives examples of their use. It is shown that first two models are the most suitable for full-time students. A general scenario for the use of blended learning models is described. Although the use of blended learning models causes several difficulties, it also essentially contributes into students’ self-study monitoring and control support.

Keywords: blended learning, rotation model, flex-model, self-blend model, online driver model.

Reviewer Dr. of Pedagogy, Prof. Odesa nat. polytechnic univ. Semenova A.V.

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