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**COMPUTER SIMULATOR TEACHING SYSTEMS
FOR PROFESSIONAL TRAINING
OF SEAFARERS**

Contemporary processes in economics and social life have given rise to a revolutionary situation in education. It is seen in bringing down a level of knowledge at both secondary and higher school. One reason for this is an outstripping development of engineering and new technologies as compared with educational advancement. Efforts to improve educational process including a broad-gauge action to introduce computers and simulators in it do not pay because such things as old contents of education, methods of educational process organization, and purposes of the existent pedagogical system remain.

A lag of educational system behind the requirements of the industry is acutely showing in marine transport. For instance, a state of safety problems makes international maritime organizations (IMO, BIMCO, ISO etc.) pay much attention to a professional training of seafarers in matters of safe ships operation and environmental management.

To understand what we should do to improve maritime education it is necessary to analyze existing contradictions between modern requirements of the industry and possibilities of the present-day training system.

Existing educational system is an explanatory-illustrative type of training. It means that the teacher gives a theory, then demonstrates examples of its practical use in the form of problems, and then offers methods of solving them. The student is only to study ready-made opinions and to train himself in solving problems following teacher's patterns. The student cannot motivate his actions and formulate questions himself, and nobody teaches him about it.

Thus, student's attention and memory are mainly burdened. Thinking becomes unnecessary since a scientist, an author of a textbook, and a teacher have been thinking for the student. The student is a taught one, i.e. a controlled link in the system of education. This, of course, does not mean that students do not think but the teacher cannot evaluate the

process of thinking because he spends all his time to manage to give ever-increasing information to his students.

This situation gives rise to the following contradictions:

1. A contradiction between an abstract subject of a cognitive activity (texts, tasks, computer and simulator programs, etc.) and the real subject of a professional activity where the knowledge is realized in the context of a workflow and under working conditions.
2. At higher school the student acquires knowledge dissimilarly (assorted disciplines, different departments, “independent” simulators) but under working conditions this knowledge is used as a whole, as a system.
3. Individual training principle contradicts the real use of knowledge while working in a group. Skills and inclinations developing under such a training could cause some strain in a team and emergencies on board.
4. The main thing in professional activity is a creative thinking while in traditional studying process it is attention, perception and memory. But the memory reflects the past. One can extract from the memory only what has been stored there before which could not necessarily correspond to the real situation and changed conditions.
5. Considerable inertia of the modern form of maritime education makes substantially difficult the adjustment of curricula taking into consideration ever-appearing new knowledge. This inevitably leads to an extensive enlargement of the volume of theoretical studying materials and forms among cadets a formal attitude towards the knowledge (unnecessary from the point of view of the student) and, therefore, their unwillingness to study. The same leads to some contraction of hours for some practical, laboratory, and simulator training.

The above-mentioned disadvantages of the traditional form of training result in a long period of adaptation (3 – 5 years) of fresh specialists on

board. This has been proved by the results of a 20 year research program made by the Makarov State Maritime Academy in cooperation with the Baltic Shipping Company. The research has shown that the adaptation of 80-90% of maritime higher schools graduates ends by the third year of their career. It is necessary to say here that about 7 – 8% of the graduates would never be able to adapt to the working conditions on board.

With regard to the above-said, an advancement of the student's thinking ability, his ability to analyze any situations quickly and make adequate decisions must become a basis for improving of the maritime educational system.

It seems it would be to the point here to pay attention to the role of simulators in improving of professional maritime training. Some 20 years ago in maritime schools of the USSR a large-scale action was organized to introduce technical means of training (TMT) into the studying process. However, the lack of training technology with the use of TMT as well as the introduction of the simulators into an unprepared studying process did not allow to change the situation for the better. The whole chapter regulating the use of simulators in a professional training of seafarers has appeared in STCW 78/95 Convention. In this document, however, requirements to the simulators have been formulated from the point of the traditional approach to training (part A-1/12 of the STCW). Criteria of evaluating of the student's competence are uncertain with unclear limits of evaluation, for example: "The conduct, handover and relief of the watch conforms with accepted principles and procedures" (table A-111/1). Unclear wording prevents from single-valued understanding of requirements, makes difficult to work out certifiable requirements to marine simulators of the new generation.

Analyses of the existing simulators show that the main goal of the training, - advancement of the professional intellect of the student – is evaluated indirectly, by estimating the operational quality of a simulator and there is no evaluation of the real level of training (abilities to make

decisions, first of all). A student can guess the right answer adding nothing to his intellect. Moreover, the knowledge obtained earlier is not used in such a training as well as the fruits of self-learning.

Thus, in order to improve the quality of the simulator training it is necessary to reconsider the training technology itself. At the Makarov State Maritime Academy a certain work has begun to form a new conception for the simulator training. It must become an undivided part of the studying process during the whole period of forming the professional intellect.

Simulators as they are now can not solve the problem because of the following:

1. Modern marine simulators are built copying real articles, most exactly reproducing all their functions, where the student has to be a subordinate and passively perform the tasks set into simulators' programs.
2. The complexity and the cost of the simulators are constantly growing while they are merely 30-50% employed.
3. Present-day simulator training has not got reliable methods to control a skills level of the student in making operational decisions (especially when working in a group). Evaluation of the quality of the training process is done through evaluating some changes in simulator parameters. This lowers the student to the level of a mechanical slave unit of the system that has no motives, no ambitions, no mentality.
4. Nowadays, when using simulator training, the leading element of the higher school, the teacher, who is to estimate the final level of professional skills, is excluded. His place is taken by the instructor who, in addition to the task of the estimation of the students level, must work the simulator, have practical skills to work the real unit, and have good enough level in psychology and professional disciplines. To train such an instructor is an unreal business. It is necessary to add here that, when using such a scheme of training, to

check the level of the accumulation of expertise is rather difficult (if not impossible at all without special tests)

Thus, an absence of indissoluble bonds between the studying process and the simulator training, an excessive complexity of simulators, a limited number of tasks performed by a simulator, and almost unreal business to train super-qualified instructors, - they are the obstacles to having desirable results when using present-day simulators.

It is necessary to create a new computer simulator system (CSS) organically integrated into the studying process beginning from the first year of study and to make a technology of its application based on an active training. Of course, the student should not be made but motivated to be active. The teacher is sure to become more active too to achieve the goal.

The control of the studying process must be active as well. It is not a level of the mastered information but the way and results of student's actions based on the information mastered and the level of student's motivation that should be controlled.

There should be considerable innovations in functions of computer simulator systems. The student should be given a dominant position. The instructor should be replaced by the Advisor who would not interfere in the studying process but would help to get rid of mistakes, formulate targets of activity, make an algorithm to achieve the goal.

As a result of some researches done at the Makarov State Maritime Academy, a new Computer Simulator Teaching System (CSTS) has been proposed. It differs from the existing simulators and works like the following. First, the Advisor (teacher, guru) gives the student necessary information on a particular topic. Next, an instructor of the CSTS forms a task. Then the student without any assistance, using the task, works with the CSTS acquiring and polishing practical skills based on the previously learnt information. If necessary, he goes for consultation to the Advisor. Having independently completed a number of tasks the student acquires

certain skills to practically use his knowledge of the material of the topic, in other words, there is an increase of a professional intellect of the student. Finally, the Advisor evaluates student's knowledge and skills using specially designed expert system.

The main functions of the new Computer Simulator Teaching System must be:

1. Consolidation and securing of theoretical knowledge in the course of the self-control with the assistance of the CSTS and the Advisor; forming of motivation and targets and their correction. This function could be called a teaching-methodical.
2. Forming of sensory-motor skills in making decisions on concrete questions of studying and training.
3. Forming skills of both personal and collective control over individual systems, the ship power plant, and the ship as a whole.

The above functions have to be effectively used during the whole period of training, divided into four phases:

Phase 1 - forming of the general intellect while studying academic subjects;

Phase 2 - forming of the general-technical intellect while studying fundamental technical and professional subjects;

Phase 3 - forming of the professional intellect while studying special professional subjects;

Phase 4 - advancing of the professional intellect while attending special extension course for seafarers.

During the phase of forming of the general-technical intellect some sensory skills are worked up to get and handle information received from informational devices (gauges, indicating lamps, digital boards, computer displays, etc.). Laboratories and practicals are used for that as well as special training programs.

During the phase of forming of the professional intellect the sensory-motor skills and skills in making decisions are developed and advanced

but at a higher level: as indivisible (complex) management skills for controlling both pieces of equipment and systems under different conditions (emergencies included).

At the end of the course of study the management skills for controlling complicated systems when working in a group are trained.

The simulator training must be transformed from the instrument for drills and practising in solving standard problems into an instrument for developing a professional thinking allowing to make correct decisions under any circumstances on board.

It is necessary to remember, as well, that one of the features of the marine transport nowadays is its extensive and ever-increasing internationalization. First of all it affects a personnel sphere of maritime business. That is why I believe that most actual and important nowadays is to join forces and achievements of teaching institutions and systems of maritime education of the countries all over the world in order to succeed in what is to be done in the field of maritime education.

At the very end I would like to say that there is no hope in improving the situation in the field of professional education until we, the teachers, grasp the full significance of a Protagoras' dictum "Man is the measure of all things."