Consideration of Individual Learning Styles in the Process of Professional Training of Future Air Traffic Controllers

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The approaches for improvement of the future air traffic controllers training efficiency according to their individual learning styles are considered. It is purposeful to use the P. Honey & A. Mumford's criteria-based test for distribution of students into four basic learning styles. The role of air traffic controller-instructor in process of rating the training is considered.

Keywords: Green air traffic controller, air traffic service, training, individual learning styles, activist, theorist, pragmatist, reflector, instructor.

1. INTRODUCTION

Development and implementation of the modern automated air traffic control systems based on advanced information technologies, a significant expansion of the range and complexity of the air traffic controllers (ATCOs) functions during air traffic service (ATS) due to the continuous increasing of air traffic flows lead to the increase in the range of professionally-oriented requirements to ATCO-students.

Studying of trends regarding to the areas of future ATCOs professional training testifies that the most promising is the individualization of training processes and presentation of training materials on the base of complex usage of the training activities types, teaching methods and tools, taking into account students' individual learning styles.

The authors' experience and the practice of ATCOs trainings show that the use of individualized training packages and tools and their adaptation to cognitive abilities of students will extend. Moreover, a student becomes an active participant of his/her own training.

Thus, in order to minimize the number of sending down from training due to the training program failures the most promising is the individualization of trainings and preparation of training packages to the future ATCOs according to their individual cognitive characteristics.

2. INDIVIDUAL LEARNING STYLES OF FUTURE ATCOS

It is purposeful to use the distribution of students in accordance with their individual learning styles that will define their own style of perception and assimilation of educational information during the initial training for future air traffic controllers.

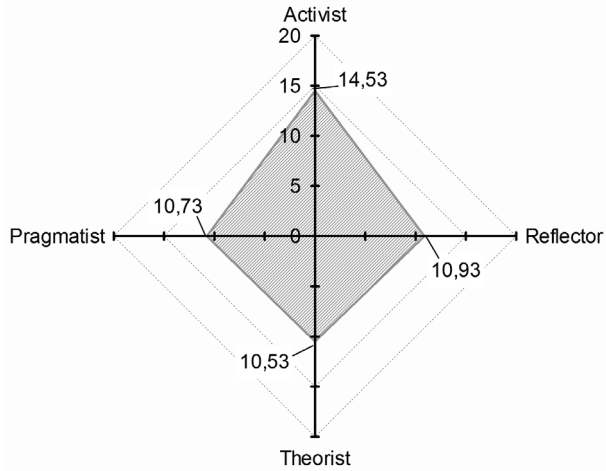
As one of possible variants we propose to use the P. Honey & A. Mumford's test which allows to distribute students into four main styles with respect to their learning activity: "Activist", "Reflector", "Theorist", "Pragmatist" [1]. This test consists of 80 questions: 4 groups of 20 questions that characterize each learning style. The agreement with a question statement is equal to 1 point. The points sum for each questions group characterizes the belonging to each learning style. Testing results of 142 future ATCOs (students of National Aviation University, Kyiv, Ukraine) are represented in Table 1.

Table 1. Future ATCOs test results.

Learning style	Number of students	Relative % to the total number of students
Activist	43	30.28
Reflector	40	28.17
Theorist	31	21.83
Pragmatist	28	19.72
Total	142	100

The diagrams in Fig. 1 show the averaged attainability domains for activists, reflectors, theorists and pragmatists groups of future ATCOs (the axes represent the averaged sum of points according to each learning style).

a)



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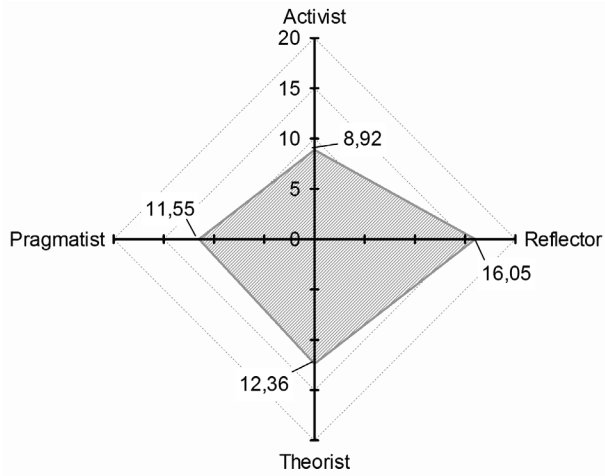

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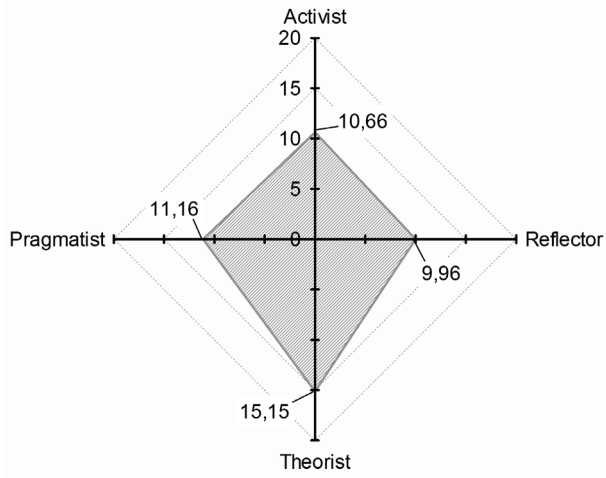

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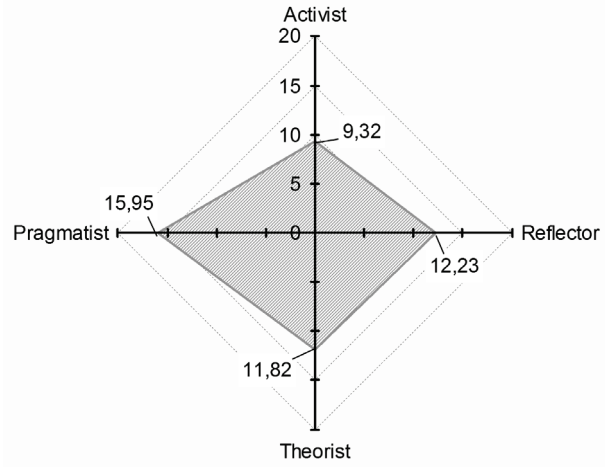

Fig. 1. The averaged attainability domains of future ATCOs:
a) activists group; b) reflectors group; c) theorists group; d) pragmatists group.

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Summarizing stated in [2, 1, 3, 4] there are following features of training material perception and learning for appropriate learning styles.

Reflectors learn better when they:

– can perform tasks at their own tempo without time constraints (prefer own learning tempo when they reflect firstly and then act);
– listen, learn and observe, pay a great attention to the data collection and analysis (reflectors prefer avoidance strategies in situations when they are required to be the center of attention);
– are allowed to think before acting;
– have the opportunity to analyze the learning materials and to think over what happened and they have learned;
– can perform time-consuming research.

Reflectors learn worse when they:
- are harassed by the pressure on them, or when they have to change the type of activity quickly;
- have to be in the spotlight, for example, to act as leaders or show a presentation;
- do not have time for preparation, i.e. they have to act impromptu;
- are forced to acting risky without support.

Activists learn better when:
- there is a wide range of tasks and opportunities in which they can learn and what they can do in the process of training materials learning;
- their assigned on responsible mission, which they find difficult;
- they have the opportunity to generate ideas and execute business games and group tasks, to perform active learning;
- they have an opportunity to manage or organize other people;
- they enjoy the practical application of their knowledge (they prefer action more than a reflection and have a negative attitude to abstract debates and theoretical reasoning).

Activists learn worse when they:
- must listen to long explanations in the form of lectures about how they should carry out the appropriate tasks;
- have to do a lot of the work themselves: read, take notes;
- are asked not to participate in activities, but only watch from the side;
- must precisely follow the instructions without showing their own initiative;
- take a part in passive learning, they have difficulties with focusing on “small parts”.

Pragmatists learn better when:
- they learn better the things, which, in their view, bring obvious practical benefits, for example, allow to save time, optimize staffing, increase capacity, etc.
- they are able to implement the obtained knowledge quickly;
- there is a relationship between the material being studied and the real issues;
- they obtain skills that require immediate usage, they like the knowledge which they can immediately apply in practice;
- they have the opportunity to experiment and get feedback from a qualified specialist.

Pragmatists learn worse when:
- they can’t see benefits from knowledge obtained, the practical usage of “things” they are study;
- there is no obvious effect of their activities, such as reducing workload, saving time etc.;
- they are not given clear instructions or opportunities for practical consolidation of the theoretical material;
- there are various kinds of external obstacles to the implementation of the material that was under study.

Theorists learn better when:
- the structure of the task and its purpose are clearly defined, and it is clear to them what they are needed to do;
- they have time to think logically about the connections of ideas, events and situations;
- they are intellectually stretched, they are putted in a difficult situation where they have to use their knowledge and skills;
- solving the complex problem issues, they use their analytical skills, correlating obtained knowledge with the wider system, model, concept or theory or "making the big picture from the fragments."
- the material under study concluded in their logic scheme, they have a clear goal before them.

Theorists learn worse when:
- they are forced to work without knowing the context or final purpose;
- they are intellectually can’t work together with other members of the group, for example, with activists;
- their activities are not structured or they are badly instructed, and they do not have the opportunity to use their ability to think logically.

To determine the degree of reliability of the above mentioned statements with respect to the individual, an additional survey of students was carried out.

The students had to answer the question “How accurately corresponds your defined learning style to yourself assessment?” using a 10-point scale. The processed results of the survey provided a generalized 80% agreement with the definition of their learning style. This is a high rate of test reliability.

The results can already be used for the large groups of students, for example during the lecture classes, directing the course material and communication methods to the dominant group of students in accordance with their general style of learning. Of course, this approach is a very first step in the individualization of training process.

During the ATCOs training (based on own experience and data from appropriate training centers abroad) the composition of the audience consists of a relatively small number of students – up to the 10 people for classroom training.

During the rating training (using ATC simulator) [5] one ATCO-instructor work usually with one student. It is already possible to carry out a full-scale individual training of future ATCO at this stage.

3. THE ROLE OF ATCO-INSTRUCTOR

Depending on the specific learning style of students, there are the following options of training process realization by an ATCO-instructor.

For an ATCO student with activist learning style the role of an ATCO-instructor is a coordinator. The objective of an instructor-coordinator is constant interaction "student-instructor" (constant comparison of student's actions with the possible consequences). The main task of a coordinator is the realization of the following chain: "the goal of training – training activities – the result (competence's parameters) – finding-out the causes of objectives and results non-compliance – developing and delivering corrective action to the student". Since activists prefer practical activities to thinking and abstract academic debate, analysis and theoretical reasoning, then the role of a coordinator is to plan activist's training profile, according to which activist will receive a certain amount of theoretical knowledge (no more and no less) that is a necessary condition for his successful practical training on the ATC simulator. Instructor-coordinator should maintain the enthusiasm of activist, but to claim that the activist had planned their practice in advance. Forms of training for activists may include various tasks associated with the provision of air traffic services. Activists get pleasure from solving problems that require significant cognitive load. But activists often do not have enough patience to do the work in order to consolidate the received knowledge and skills.

For an ATCO student with a reflector learning style the role of an ATCO-instructor is an expert. An expert defines the objectives for a reflector in accordance with the required professional competences model, and creates the most appropriate profile of training process. The tasks of an expert are:

- to support the reflector during the practical application of theoretical material;
- early identification of the factors of negative influence on the process of training and development of corrective actions;
- organization of the schedule and media environment for continuous self-training and practical development of skills and acquisition of and obtaining experience in a structured form (with clearly defined activity algorithms) of air traffic control.

As reflectors prefer actions according to instructions, an expert should plan phased training (step-by-step) with well-defined input and output parameters of each phase of training.

For an ATCO student with a theorist learning style the role of an ATCO-instructor is a consultant. Students-theorists solve complex problems using their analytical skills in the process of building of own mental model of the "big picture from pieces" from the unrelated pieces of information. This is due to the high intellectual level and ability to develop and implement their individual training profile knowing the final goal. For a consultant it is enough just to demonstrate practical ways of solving different tasks, first of all it concerns practical air traffic control. Supporting the theorist's training process is not so active: a consultant observes and provides assistance to a student upon request. A consultant has to ensure that the learning material is in the logic of a student action and the tasks are clear for a student (theorists always should have clearly defined structure of the task and its purpose).

Taking into account that theorists prefer the analysis and synthesis of information, logical reasoning in the process of studying the theoretical material, consultants should provide them the ability to draw conclusions on their own, giving time to think logically about how facts, events and situations are interconnected.

Training tasks for a theorist must have clearly defined purpose and be quite difficult for practice, because theorists work effectively when they are intellectually strained, put in a difficult situation, where they have to use the obtained knowledge and skills.

For an ATCO student with a pragmatist learning style the role of an ATCO-instructor is a tutor. As mentioned earlier, pragmatists learn better when they can quickly implement the received information, moreover, they like to get the knowledge which they can use immediately in practice. Especially when tutor's advice allow them to solve specific practical situations (so-called "supervised practice").

A tutor should help a pragmatist:

- to determine the current (intermediate) training targets in quantitative values and means for their achievement;
- to motivate himself/herself (the motivating factors are primarily material: bigger salary after training, good job etc.);
- to identify the reasons or factors of training progress inhibiting and to develop an effective corrective actions as soon as possible.

Pragmatists typically learn through practical activities, that's why the focus has to be on practice, not theory. The provided information (educational material) must be applied to practical training (when there is an explicit link between the studied material and the real problems that may occur). The technologies and techniques for actions during ATS should have clear points of execution.

4. CONCLUSIONS

There are no distinct activists, reflectors, theorists and pragmatists. Each individual has a specific set of indicators from these four learning styles.

However, it is possible to improve the effectiveness of an ATCO-student training using information about his/her dominating learning style. The improvement is based on creating of more individualized educational packages, that are maximally focused on training features of each student. At the same time, a student becomes an active participant in the process of his/her own professional training development.

There are the following main stages of a student's individual training system creation:

- development of a syllabus and a training plan in accordance with the requirements of a customer (air navigation services provider) for the output model of ATCO (required competencies) for the appropriate ATC unit (area control centre, approach, aerodrome control tower);
- identification of a student's learning style;
- development of individualized educational packages, delivering knowledge and developing skills to the student in accordance with his learning style;
- identification of the key markers of training according to the training "profile" of the students in order to determine the learning progress.

This approach, compared to traditional, has the grater economic efficiency due to the fact that required training tools, hours and personnel are determined according to individual cognitive parameters of students.

Taking into account the individual learning styles, students will improve their professional competence and the reliability of human-operators in the ATS system.

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