Human Factors and Analysis of Methods, Forms and Didactic Means of Aviation Education of Military Pilots

P. Kaľavský*, S. Ďurčo*, R. Rozenberg*, M. Antoško*, V. Polishchuk*, J. Jevčák*, L. Choma*,

R. Klír* and A. Tobisová**

* Faculty of Aeronautics, Technical University of Košice/Department of Flight preparation, Košice, Slovakia
peter.kalavsky@tuke.sk, stanislav.durco@tuke.sk, robert.rozenberg@tuke.sk, v.polishchuk87@gmail.com, jaroslav.jevcak@tuke.sk, ladislav.choma@tuke.sk, robert.klir@tuke.sk

** Faculty of Aeronautics, Technical University of Košice/Department of Air Traffic Management, Košice, Slovakia
alica.tobisova@tuke.sk

Abstract—**The aim of the paper is to examine the methods, forms and didactic means of aviation education of military pilots at the selected institutions from 1973 to the present using the analysis for the quality teaching process and the interaction of edutants (human factors) - teachers and students, based on the SWOT analysis of selected historical data. The paper is the second part of the study on the issue of aviation education, which answers the question of strengths and weaknesses, risks and opportunities for the future education quality aspects. The main motive of our pre-research and historical data analysis is to acquire the knowledge applicable to the creation of new study programs of the Faculty of Aeronautics of the Technical University of Košice (FA) in the study field Transport according to the new descriptions approved by the Accreditation commission.**

Keywords: methods, forms, didactic means, aviation education

I. INTRODUCTION

According to the goals and requirements for the professional competence, knowledge and skills, we formulate the content of aviation education. The practical implementation of the content of aviation education is reflected in the appropriate methods, forms and didactic means.

The historical and content analysis of study programs of aviation education of military pilots from 1973 within Czechoslovakia, or from 1993 within Slovakia, will allow the research (identification, analysis and evaluation) of data.

The research is focused on the structure and quality of methods, forms and didactic means of aviation education as well as their comparison in the study programs (in the research periods).

The method of comparison, synthesis, induction, deduction and SWOT analysis will support the formulation of preliminary conclusions of the forthcoming study in this section.

The right choice, the optimal use of the potential in the teaching process can highlight and multiply the content of aviation education, which is the subject of transformation between the edutants – human factors in education (teachers and students). On the other hand, the wrong choice, not utilizing the foreground potential, the methods and the didactic means in the teaching process can undermine the educational content, and endanger the attainment of the education and training objectives. For these reasons mentioned above, there is a social need and importance of researching the issue, within the framework of aviation education, as a didactic system in the specific application field of human activity [1].

The subjects of the research are the methods, forms and didactic means of aviation education of military pilots carried out at the institutions since 1973 in Slovakia until now at the Faculty of Aeronautics of the Technical University in Košice (FA).

The aim of the paper is to examine the methods, forms and didactic means of aviation education of military pilots at the selected institutions from 1973 to the present using the analysis for the quality teaching process and the interaction of edutants (human factors) teachers and students, based on the SWOT analysis of selected historical data.

II. DISCUSSION AND RESULTS

The final version of the study, which will have a minimum of 5 subchapters within the analytical section, will be part of the internationally created ***Expert Database of Civil and Military Aviation Experience*** in the fields of:

- Academics subjects,
- Simulation and modelling of Security issues, as in [2-11],

- Technical Sciences, as in [12-18],
- Civil / Military / Air Force management, education and training etc. as in [19-38].

The results of the study of large amount s of study programs in 1973 and the present are concentrated in the transparent tables for our academic discussion and conclusions.

The backgrounds and limits for the assessment: The evaluation and comparison of aviation education content from 1973 to the present was done in the first article of the authors.

In the second paper we have assessed the data of aviation education in the following areas: The Methods and forms of teaching used in the military pilot education at the Military higher aviation school, Methods and forms of teaching used in the military pilot education at the Faculty of Aeronautics (FA), Didactic means used in education of military pilots at the Military higher aviation school, Didactic means used in education of military pilots at the Faculty of Aeronautics (FA).

The research database included the period of the years 1973-1990, in the original name "Vysoká Vojenská Letecká Škola Slovenského Národného Povstania v Košicich".

The research database included the period of years 2004-present, the Faculty of Aeronautics of the Technical university of Košice, the Slovak republic.

TABLE I.
METHODS AND FORMS OF TEACHING USED IN THE MILITARY PILOT EDUCATION AT THE MILITARY HIGHER AVIATION SCHOOL

Identified data
In teaching methods used in military pilot training at the Military higher aviation school, verbal methods prevailed with the practical methods such as skills training on flight simulators. The educational attention was given to pilot motivation and fixation methods for repetition and consolidation of the essential knowledge essential for practical aviation activity. The little emphasis was placed on using a group of problem methods.
Basic education forms of education such as lecture, seminar, exercise and laboratory exercise were used in education. The lessons were carried out on special classrooms designed for teaching the subject of aircraft pilot specialization using the aforementioned audiovisual and projection techniques.
The exercises and workshops used models, images and audiovisual aids below, focusing on the use of didactic materials corresponding to the type of aircraft and a group of tasks in practical flight training. Laboratory exercises were carried out in a laboratory of applied physics, in a wind tunnel laboratory and in a laboratory of aircraft engine control systems.
The basis for practical training for the pilot study course was the workplaces of aircraft simulators L-29 and L-39. The professional experience represented by practical flight training at the air department played an essential role in the professional, qualification and educational aspects.
Oral and written testing of diagnostic and classification methods supplemented by practical flight simulator testing was essential.

TABLE II.
METHODS AND FORMS OF TEACHING USED IN THE MILITARY PILOT EDUCATION AT THE FACULTY OF AERONAUTICS (FA)

Identified data
The basis for pilots' education is still a practical skill training method for flight simulators implemented in separate subjects Pilot Simulator Training I, II and II and in the Flight Planning and Monitoring.
In the teaching methods used in the military pilots' university teaching since the establishment of the Faculty of Aeronautics, verbal methods prevailed, however, supplemented by methods represented by student participation in projects and research conducted at the profile departments.
In education, the basic organizational forms of education such as lecture, seminar, exercise and laboratory exercise are used. The lectures are carried out on special classrooms designed for teaching subjects of the specialization pilot aircraft equipped with modern audiovisual and projection equipment. The exercises and seminars use modern didactic material resources such as software for creating learning systems and electronic courses on the internet MOODLE, software for testing and evaluating students Wondershare quizcreator, software to simulate the performance of satellite navigation systems Trimble GNSS Planning and NAVBLUE - Flight Operations & Air Traffic Management Solutions, VFR and IFR flight planning software such as FliteStar - Jeppesen's and others.
Laboratory exercises are carried out in a laboratory of applied physics, in a wind tunnel laboratory, in communication and navigation systems, in avionics systems and in an aircraft engine control laboratory. The basis for practical training for the pilot study course is the workplaces of aircraft simulators Cessna 172, Cessna 172 RG, Beechcraft Baron BE-58. Professional experience represented by practical flight training in aviation schools and air units of the Air Force of the Slovak Republic plays an essential role in the professional, qualification and educational aspects.
Diagnostic and classification methods are fundamentally represented by oral and written testing supplemented by the use of MOODLE, Wondershare quizcreator and practical flight simulator testing.

TABLE III.
DIDACTIC MEANS USED IN EDUCATION OF MILITARY PILOTS AT THE MILITARY HIGHER AVIATION SCHOOL

Identified data
Models On-board aircraft instruments - navigational indicators with movable hands and scales such as: RBI, RMI, CDI, HSI, EHSI and so on. Navigation counters - LNP56, LNP-1, DR1 and 2 Aerodromes with visual navigation aids and the deployment of radio-technical and light-technical equipment. Airborne situation when shooting air targets, atmospheric fronts, meteorological phenomena Aeronautical instruments and equipment, aircraft engines and on-board systems diagrams.
Views: Topographic terrain maps (plastic maps, globes), special destination maps - aerial maps, blank maps. Graphic materials to illustrate the functions of aircraft instruments and systems.
Didactic technique Audiovisual and projection technology: meotar and epirex overhead projectors, slide projectors, film projectors, televisions. Sound technology: tape recorders for foreign language teaching and radio correspondence. Display and projection screens: boards, canvases. List of special laboratories and workplaces used to teach pilots: Laboratory of wind tunnels, Laboratory of Applied Physics, Laboratory of Intelligent Control Systems of Aircraft, Laboratory of Communication and Navigation Systems, Aircraft Simulators L-29 and L-39.

TABLE IV.
DIDACTIC MEANS USED IN EDUCATION OF MILITARY PILOTS AT THE FACULTY OF AERONAUTICS (FA)

Identified data
Models Aerodromes with visual navigation aids and the deployment of

radio-technical and light-technical equipment. Aeronautical instruments and equipment, aircraft engines and on-board systems diagrams.
Views Topographic terrain maps (plastic maps, globes), special destination maps - ICAO air maps, blind maps. Graphic materials to illustrate the functions of aircraft instruments and systems.
Audiovisual Aids Audiovisual computer programs (DVDs) in the field of flight and technical training subjects, educational films with subjects of air and technical training. Computer simulations of the use and function of on-board indicators, systems and aircraft engines. LMS (Learning Management System) - software for creating educational systems and electronic courses on the Internet (used by MOODLE). Student testing and evaluation software (Wondershare quizcreator). TV programs. Professional texts.
Didactic technique Audiovisual and projection technology: data projectors, interactive whiteboards. Sound technology: computers and their peripherals for foreign language teaching and radio correspondence. Display and projection screens: boards, canvases. Computer classrooms. PC workstation assemblies. List of special laboratories and workplaces used for pilots teaching: Laboratory of wind tunnels, Laboratory of Applied Physics, Laboratory of Instrumentation and Electronic Systems of Aircraft, Workplace of Professional Readiness of Air Operators, Laboratory of Communication and Navigation Systems, Computing and Design Laboratory of Avionic Systems, Laboratory of Electrotechnics, Workplace of Unmanned Aerial Vehicles UAV Systems and Flight Simulators (Cessna 172, Cessna 172 RG, Beechcraft Baron BE-58) and Air Traffic Control Simulators (LETVIS, Procedural Management).

III. CONCLUSION

The research database of the study programs of the institutions in Košice, which have been and are currently responsible for the preparation of new military pilots, has allowed us to carry out the comparison of the current state of education of military pilots at FA with the past based on the factors for SWOT analysis.

TABLE V.
SWOT RESEARCH DATA 1973-1990

Strengths / Period 1973-1990
Adequate material, financial and staffing of the institution. Choice of students through admission. Organized life of students in a military team with the possibility of time and space for personal preparation for study. High level of competence of teachers with practical experience in the operation of military aviation technology. Linking theory with flight practice through collaboration between educators and the training unit, and coordinating theoretical training of students in vocational subjects with practical flight training tasks. Organization of a substantial part of the training of the training institution, allowing flexible adaptation of theoretical training to the needs of flight training. Ensure the teaching of vocational subjects with a sufficient number of teaching aids such as models and images. Content of study programs ensuring the sufficient physical readiness of pilots and special physical training.
Weaknesses / Period 1973-1990
In the early stages, the lack of clarity in the content and scope of the theoretical foundations of the learning programs. Limited use of didactic material resources at that time. Limited language learning opportunities.
Opportunities / Period 1973-1990
Motivation of students to ensure their practical application. Ensuring the practical application of students in air services as requested by the Air Force. Material provision for students' life during their studies as a result of their positions as aviation personnel. Material and health provision of training and student training appropriate to future aviation practice.
Threats / Period 1973-1990
Limited number of candidates meeting the health requirements of a military pilot. Politically limited admission to study in accordance with the principles of the school policy of the Communist Party of Czechoslovakia. Limited opportunities for cooperation with both civil and military foreign educational institutions. Limited possibilities for elimination of non-compliant students resulting from the principles and objectives of personnel work.

TABLE VI.
SWOT RESEARCH DATA 2004-2019

Strengths / Period 2004-2019
High level of competence of educators. The most of teachers have practical experience in the operation of aviation technology. Linking theory with aerial practice through collaboration between teachers and aeroclub providing basic training. Organizing a part of the training in the place of training of the training institution, allowing flexible adaptation of the theoretical training time to the needs of flight training. Using of computer technology as a means of didactic technology and teaching aids. Using of flight simulators and implementation of their use in the study program. Increasing the emphasis on the foreign language teaching, especially English language
Weaknesses / Period 2004-2019
Condition of buildings and insufficient equipment of premises. Lack of funding. Number of teaching staff and structure of teaching staff for continuity in the teaching of the main objects. Recruiting students, impossibility of selecting students through recruitment. The university study programs are aimed only at the requirements of civil pilot training. Coordination of theoretical training of students in vocational subjects with the practical training of aeroclub training and military training units.
Opportunities / Period 2004-2019
Involvement in the foreign projects and calls of research agencies. On the basis of university aviation education of military professionals, the university study in daily form in the accredited study programs is provided by FA. Student motivation resulting from the assurance of being asserted as a military pilot. Support for the English language teaching and staffing and institutional support The possibility of cooperation with civil and military aviation institutions.
Threats / Period 2004-2019
The knowledge and creative potential of students selected for military specialization Limited number of candidates meeting the health requirements of a military pilot. Changes in the organization of Air Force Reduction of resources and number of techniques for continuing flight training. Demographic development. Competition between educational institutions at home and abroad and civilian organizations providing the pilot training.

The interpretation of pre-research results in the tables I-IV and the SWOT analysis, the knowledge applicable to the creation of new study programs:

Our historical data analysis presented that basic education forms of education such as lecture, seminar, exercise and laboratory exercise were used in the aviation education. The lessons were carried out on the special classrooms designed for teaching the subject of aeroplane (aircraft or helicopter) pilot specialization using the aforementioned audiovisual and projection techniques. The financial investment in the modernization of classrooms and laboratories is our constant challenge. The prospective information and communication technologies with the aerospace applications are in demand. A special emphasis is on the modernization of the simulation center for pilot training. The diagnostic and classification methods are fundamentally represented by oral, written or computer testing. The aeronautical practice requires the mobile applications to support an independent theoretical pilot training. The strengths of aviation education are mainly the linking of theory with the flight practice through the collaboration between the educators and training unit, and coordination of the theoretical training of students in the vocational subjects with the practical flight training tasks. The threat of aviation education is the lack of suitable candidates and the reduction of resources and techniques for continuing the flight training.

The paper reached the aim to examine the methods, forms and didactic means of aviation education of military pilots at the selected institutions from 1973 to the present using the analysis for the quality teaching process and the interaction of edutants (human factors) - teachers and students, based on the SWOT analysis of selected historical data.

The following research in the area will be focused on the risk assessment of university aviation education of military pilots at the selected institutions from 1973 to the present.

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