KHALIFA BIN ZAYED AIR COLLEGE

‘Good Practice’ Title:

‘Improving Student Experience’ through the establishment of

SMART LABS and VIRTUAL REALITY LABS at KBZ AC, Al Ain

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I. Introduction and Purpose

KBZAC strives to fulfill its mission of achieving student success through quality education. KBZAC seeks continual improvement in all facets of the institution—tangible and intangible—to realize this mission.

As part of this initiative, KBZAC has invested a huge amount of money and efforts in developing and establishing SMART LABS and VR LAB to provide practical support and enhance the student cadets learning experiences.

The establishment of fully functioning SMART Labs and VR Lab at KBZAC relates directly to the CAA standard (2.2 Continuous Quality enhancement as well as to the standard (Stipulations 4.4.4 – Classrooms and Workshops/Laboratories).

The study of Aviation Science involves both theoretical and practical aspects. The student cadet learns in the classroom what is already known or thought about a science and, in the lab, experimental methods for discovering new knowledge. The crucial role of practical work and experimentation in aviation programs curriculum is universally accepted. This is more so in Aviation Systems, as the trainees should have a hands-on experience before he/she reaches real aircraft environment.

KBZAC has well established Labs for the Aviation Science program that includes;

1. Aircraft Systems & Component lab.
2. Avionics lab.
3. Aero Engines lab.

4. Instruments lab.
5. Physics lab.
6. Navigation lab.
7. Survival lab**.**

Since, the Aviation sector grows rapidly and the technological development and the systems it uses in its aircraft and its operations changes too fast, it is imperative that the Labs that are used at KBZAC are also equipped with the latest cutting-edge technology with the option to upgrade and update by using different Applications and software and without the need to buy any new hardware. Therefore, KBZAC initiated the process of establishing the following Labs and implemented these in phased manner.

1. Smart Lab 1
2. Smart Lab 2
3. Virtual reality (VR) LAB

The purpose of establishing the SMART LABS is for the student cadets to have hands-on experience through On-Screen Activities (OST) which will help them in real life situations. The purpose of Virtual Reality (VR) Training Lab is to enable the student cadets to visually experience and perform actions on certain activities which will help them in real life situations. These SMART and VR Labs are highly useful as any latest updates can be incorporated into the existing equipment using Applications and software. Moreover, new courses, their exercises and activities can be integrated into these SMART labs and VR Lab seamlessly.

The aims and objectives of the practical sessions in these SMART labs can be stated as follows:

- Better understanding of scientific concepts and principles of aircraft system and components.
- Promotion of basic skills and competencies
- Awakening and maintaining curiosity in the learning environment

II. Significance of the Good Practice in the QA System

KBZAC implemented the SMART Labs and VR Lab in two Phases. Phase 1 in the year 2018 and Phase 2 in June 2023. Since, the cost of development and implementation of the labs was very high, KBZAC had decided to implement these Labs in two phases.

The Phase 1 Labs initially covered certain courses and their exercise/activities and provided hands-on practical experience to the student cadets. However, as part of continuous improvement in providing higher quality of education, to ensure full utilization of these labs which was one of the requirements of the CAA and to improve student cadets learning experiences, the SMART labs were upgraded and a greater number of courses and their related exercises/activities were introduced in Phase 2.

Benefits for Students

- VR Lab

The VR Lab provides extensive opportunities for student cadets to learn in a simulated environment with the latest technology OCCULUS VIRTUAL REALITY GLASSES AND HAND SENSORS. In addition, the VR Lab

are equipped with Fixed Wing Motion Simulator with Chair and TV screen for student cadets to learn practically and improve their experience.

The VR and Motion Chair Activities in this lab are covered under subjects:

- AVS 2133 - Aircrew Survival
- AVS 3103 – Airmanship
- AVS 3163 – Principles of Flight for Helicopter
- AVS 2123 – Principles of Flight

- SMART LABS

The two highly sophisticated SMART Labs equipped with cutting-edge technology provides extensive simulated learning opportunities to the student cadets with THRUSTMASTAR HOTS WARTHOG CONTROLS.

The on-screen activities in these labs are covered under subjects:

- Helicopter Aerodynamics
- Fixed Wing Aerodynamics
- Physics
- Avionics and Instruments
- Engine
- ATC Phraseology (ATC)

KBZAC ensures that student cadets obtain maximum benefits from these labs and gain valuable learning experience. Moreover, many courses have practical assessments ranging from 10% to 15% of grades allocated for Practical and Lab Assignments. Hence, student cadets are encouraged and motivated to do well and score maximum grades from these lab assessments for different courses.

Responsibilities

KBZAC ensures that the responsibility for providing student cadets with a safe lab environment lies with college administration team, the aviation science faculties, lab officers and the cadets themselves. Before taking cadets, either the associated faculty or the lab officer in-charge ensures that the lab is complying with safety regulations. The associated faculty also ensures that the activity practiced by the Student cadets are in line with any of the Course Learning Outcome (CLO's) of the specific subject. Instructive lectures will be given during lab sessions, if necessary.

Lab Standard Operating Procedures

In order to ensure a safe and healthy learning environment for the student cadets that will contribute towards their improved learning experience, KBZAC has laid down Lab Standard Operating Procedures that must be adhered to strictly by the student cadets and staff;

a. General Safety Principles
b. Health and Hygiene
c. Food and Drink in the Laboratory
d. Housekeeping
e. Lab Security
f. First Aid Boxes
g. Fire Extinguishers and Fire Alarms

Below are some of the examples of how the VR Lab and SMART Labs trainers will contribute immensely in improving the student experience in learning practically various exercises and activities related to various courses of the Bachelor of Science in Aviation Sciences program in simulated environment.

Airmanship Virtual Reality Trainer

The Virtual Reality Trainer will enable the trainee to visually experience and perform actions for certain activities listed and described below, in a virtual real-life like environment using virtual reality goggles:

- Circuit Pattern Flying

Following are the sequence of actions that the student will experience using the virtual trainer:
The student will be placed in a PC 21 cockpit. The takeoff, circuit pattern flying, and landing scenarios will be simulated virtually. This is a scenario-based simulation and not a free play. Cockpit indications will not be replicated as the context of the simulation is to show the flying environment only.

- VOR Tuning and Identification of the Morse Code of Al-Ain and other airports of UAE (Note: Only at Al-Ain airport)

Following are the sequence of actions that the student will experience using the virtual trainer:
The student will be placed in a PC 21 cockpit, the student will interact and tune a frequency on the radio for 1 of the 20 airports in the UAE, the student will hear a different Morse code for each airport, and an approach chart for each airport with the Morse code will be displayed to the student. The frequency for all the 20 airports will be listed, and the student can tune to any one frequency, to hear the Morse code

and see the approach plate. This is a scenario-based simulation and not a free play. Cockpit indications will not be replicated as the context of the simulation is to show the flying environment only.

Met Scenario On Screen Trainer

The Met Scenario On Screen Trainer will enable the trainee to visually experience certain activities listed and described below using a TV/Monitor screen:

- Scenario to show the pressure changes when flying between 2 points of differential pressure (Screen Simulation)
- Flying into Hailstorm, with the sound of hails hitting aircraft
- Simulate flying into mountain waves to show the altitude variation due to pressure change
- Simulate the change of state of water, especially water gets evaporated, then get saturated in the air and settle down as rain.
- Microburst

Helicopter Aerodynamic Trainer

The Helicopter Aerodynamic Trainer will enable the trainee to visually experience and perform actions for certain activities listed and described below on:

- Movement of the cyclic stick and change of the direction of the axis of rotation of rotor disk
- Movement of the collective lever and change of the rotor thrust
- Movement of the rudder pedals and change of the amount of tail rotor thrust
- Movement of the collective lever and change of coning angle
- Demonstration of wash in and wash out of rotor blades
- Effect of cyclic and pedals – horizontal flight, coning angle

- Auto rotation
- Hover (instructor introduces disturbances)
- Forward flight and turns
- Vortex ring
- Tail rotor failure (in hover and forward flight)
- Ground resonance
- Dynamic roll-over

This helicopter aerodynamic trainer is a scenario-based simulation tool and not a free play tool. Cockpit indications will not be replicated as the context of the simulations is to show the aerodynamic effect only.

Fixed Wing Aerodynamic On-Screen Trainer

An on-screen aerodynamics trainer to demonstrate and interact with the working of the following conditions using a TV/Monitor screen:

- Forces acting in forward flight and turns
- V-speeds
- Types of wings and its lift characteristics
- Types of flaps and its effect on lift and drag
- Movement of the yoke and change of direction of aileron
- Movement of the yoke and change of direction of elevator
- Movement of the rudder pedals and change of direction of rudder
- Demonstration of the drag with respect to the changes in airspeed

This fixed wing aerodynamic trainer is a scenario-based simulation tool and not a free play tool. Cockpit

indications will not be replicated as the context of the simulations is to show the aerodynamic effect only.

III. Demonstration of Improvements

The following are the ways in which the student learning experience is improved with the establishment and implementation of Practical Simulation sessions using SMART Labs and VR Lab technologies at KBZAC;

a. Enhancing the student's overall learning experience by practically doing exercises and activities in a simulated environment before they reach the stage of real aircraft environment.
b. Student cadets will be exposed to tools and equipment in classroom environment and learn their operations and gain valuable hands-on experience.
c. Focus on building skills and knowledge using classroom-based technology that is found in real aircraft.
d. KBZAC can determine the suitability of student cadets moving further into flying division with appropriate skills and knowledge demonstrated in simulated environment.
e. Offering additional training and learning opportunities for student cadets using the SMART Labs and VR Lab and enhance their skills and knowledge and improve their overall learning experiences.

IV. Conclusion

Learning Aviation programs and their courses with the help of SMART Labs and VR lab play a vital role in the development of student cadets' overall skills and knowledge. The Labs at KBZAC are highly sophisticated and equipped with cutting edge technology that helps in improving the learning experience of student cadets. Moreover, the full utilization of these SMART labs by integrating them with various courses and their exercises/activities of the Bachelors' of science in Aviation Science programs at KBZAC has contributed towards enhancement of quality standards of the program. Student Cadets learning experience has significantly improved and has helped in achieving continuous improvement in the quality of education provided by KBZAC as a Higher Education Institute in the UAE. Hence, we strongly believe that our submission merits Best Practices CAA publication.

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