Technical Review

A Study on the Education and Learning Culture for the Safety Promotion of Student Pilots in Approved Training Organizations

Kyung Su Ahn[*], Won Kyong Jeong[**]

ABSTRACT

교육은 준비, 발표, 적용, 복습 및 평가 순으로 이루어지고, 학습은 경험의 결과로 개인의 지각, 사고, 느낌, 행위의 방식에 의해 변화될 수 있다. 고로 초기 조종사를 양성하는 과정에서 교육과 학습은 안전문화 증진을 위한 매우 중요하다. 항공안전법에서 국내 조종사를 양성하기 위해 전문교육기관(ATO)을 국토교통부로부터 승인을 받아야 하고, 또한 항공안전관리시스템(SMS)도 승인받고 안전관리 활동이 의무화됐다. 조종사가 되기 위한 첫 관문인 학생조종사에게 국가 항공안전관리 정책 및 목표에 부합하도록 달성 가능한 수준의 항공 업무의 안전목표를 수립하고 그 구성원들이 학생조종사에게 안전문화를 형성할 수 있도록 효과적인 교육과 학습 방안을 마련해야 한다. 본 연구는 조종사양성 전문교육기관에서 교육을 받고 있는 학생조종사의 교육과 학습에 따른 단계별 안전의식을 알아보고, 학생조종사가 안전문화를 형성하는데 초기교육과 지속적인 교육을 통해 학습문화을 만들고 도움이 되는지 연구한다.

Key Words : ATO(Approved Training Organizations, 항공종사자 전문교육기관), Learning Culture (학습문화), SMS(Safety Management System, 항공안전관리시스템), Preparation(준비), Presentation(발표)

Ⅰ. INTRODUCTION

As part of efforts to enhance the overall competitiveness of the aviation industry and provide intensive services to aviation workers who are expected to be greatly lacking as a result of the growth of the aviation industry, a system of designated professional education institutions has been established and operated in terms of ICAO Annex I (Personnel Licensing)[1]. Korea's ATO was first introduced in accordance with the Aviation Act revised on December 14, 1991, the Enforcement Decree of the Aviation Act revised on August 17, 1992, and the Enforcement Rules of the Aviation Act revised on February 13, 1993[2].

The National Aviation Safety Program under the Aviation Safety Act shall be operated with the approval of the Minister of Land, Infrastructure, Transport, and Tourism in accordance with the Aviation Safety Program under Article 58 (1) of the Aviation Safety Act[3].

* Professor, Department of Flight Operation, Chodang University
** Professor, Department of Flight Operation, Chodang University
  Corresponding Author E-mail : sky@cdu.ac.kr
  Corresponding Author Address : 380 Muan-eup, Muan-gun, Jeollanam-do, Korea

1) A Study on the Improvement of the Aviation Workers' Credential System and Advancement of Educational Institutions, December 2015, Hwang Jae-hyuk, Kim Ki-woong, Kim Kwang-il, and Park Hak-soon of the Korea Institute of Industrial-Academic Cooperation.
2) Standardization of Airline Qualification Test and Improvement of Approved Training Organizations System, September 2010 Korea Aviation Promotion Association.
3) Ministry of Land, Infrastructure and Transport, Article 58 of the Aviation Safety Act, August 27, 2019.

Through SMS education and training, employees are encouraged to understand and actively participate in SMS. This is from top managers to all employees, promoting the efficient use of the system and raising awareness of safety.

In addition, for safety promotion such as safety culture, training, data sharing, and activities supporting the implementation and operation of the aviation safety management system, service providers are required to provide education on concepts, processes, procedures, and information related to aviation safety management systems (Kim, 2014). The development of a comprehensive aviation safety management system, however, requires practically usable safety procedures and aviation safety education, as well as a detailed analysis in order to produce it (Choi, 2008).

Training to become a pilot has never been easier. This is because trainees are becoming aware of the concept and necessity of a safety management system. Also, there is the establishment of a culture in which safety is shared and the development and implementation of training courses that promote the safety of trainees and organizations. It can be inferred that safety education and learning are necessary to develop and apply.

It can be concluded that safety education and learning are essential to applying and implementing safety procedures. The view presented here disproves the idea that successful implementation of an aviation safety management system requires research into the organization's learning culture in order to improve learning effects on aviation safety-related education and training (Kim, 2014).

As a result, when individual pilot mistakes or organizational mistakes impact safety, it is imperative to look at how to turn knowledge into a valuable tool. This will help improve the quality of safe operation[4].

The purpose of this study is to investigate the safety awareness of student pilots in the context of their education and learning at pilot training institutions. Furthermore, it evaluates whether students can contribute to a learning culture through their initial and continued education.

II. THEORETICAL BACKGROUND

2.1 Education and Learning

Education can be defined differently by different individuals depending on how they view the world, their values, and their aspirations. Therefore, education cannot be clearly conceptualized as 'what'. However, the overall image of education can be drawn by considering the appearance of education that has been conducted before or referring to the contents that have been recorded[5].

Learning theory describes how people acquire skills and knowledge according to the theory asserted by psychologists and educators. There are three types of learning theories: classical, operational, and social. The classical conditioning process is based on the association created between neutral environmental stimuli and natural stimuli[6]. In contrast to maturity, which is an instinctual change, learning involves a continual process of perception, recognition, and change that is the result of direct or indirect experience. Behavior changes are distinguished from those related to general adaptations of the organism to changes in the environment and temporary motivations such as physical

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4) GAIN(Global Aviation Information Network), "A Roadmap to a Just Culture: Enhancing the Safety Environment", Working Group E, 2004, pp.4-7.

5) Field pedagogy - Theory and Practice of Education - co-authored by Kim Mi-hwan, Choi Yoon-jin and six others, Alumni Temple, 2008.

6) FAA, "Aviation Instructor's Handbook", FAA-H-8083-9B, 2020, pp.3-2~3-3.

fatigue and bodily damage. There is a distinct difference between learning and studying in that learning is dependent on external education or phenomena whereas studying is more spontaneous (Mayer, 2001).

2.2 Learning Culture

The term "learning culture" combines the concepts of learning and culture. Learning is literally the process of learning and acquiring knowledge. In other words, it refers to the acquisition of knowledge or the change in behavior or potential that occurs as a result of experience[7].

Pedagogically, learning is the process of practicing, training, and gaining experience in a manner that results in the desired change in relatively permanent behavior. The concept of culture, on the other hand, may be defined as a process and result that has been accumulated by mankind over a long period of time by interacting with each other and the environment (Jeong, 2021).

Learning culture can be defined as the process of continuously changing behavior or acquiring updated knowledge through mutual change. This is done in an environment where individuals or groups are constantly interacting. As (Jeong, 2021) noted, human learning is inherently cultural, as a source of education, and as an important factor in the development of personalities, they influence one another.

Safety culture classifies the five components into five categories: information culture, learning culture, reporting culture, justice culture, and flexibility culture. Learning culture is defined as "preserving an organization's spontaneity and responsiveness to produce desirable results from safety information systems and to apply them in a more effective way"(Kim, 2014; Reason, 1997). In other words, learning is a lifelong process and an essential element of early job training. It involves developing and applying skills and knowledge to promote organizational safety, and obtaining safety lessons from safety reports and management updates (Kim, 2014)[8].

2.3 Approved Training Organizations Pilot Training Program

The Minister of Land, Infrastructure, Transport, and Tourism may designate a person who intends to train aviation workers as an Approved Training Organization (hereinafter referred to as "ATO") according to the provisions of the Ministry's Ordinance[9]. In order to provide aviation workers (pilots) with approved training programs, C University has established approved training organizations based upon the regulations of the Aviation Safety Act and the Enforcement Rules of the same Act, attached Table 1 (standard for designation of "ATO")[10].

Table 1 below shows the minimum curriculum of C University, an Approved Training Organization in pilot training.

Ⅲ. RESEARCH METHODS AND CONTENTS

Considering the possibility of bias during the survey process, this study was focused on

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7) ⓐ Seoul National University Education Research Institute (1995), Educational Terminology Dictionary, Seoul: Haudong Seol.
ⓑ So-Im Jeong, and Mi-Gyoung, Journal of the Korea Entertainment Industry Association(JKEIA), Vol. 15, No. 3, 30-April 2021.
8) Ministry of Construction and Transportation Aviation Safety Headquarters, "Safety Management Manual", Ministry of Construction and Transportation (Ministry of Land, Infrastructure and Transport), 2007, p.54.
9) Aviation Safety Act, Article 48 (Designation of Approved Training Organizations, etc.), [Act No. 18566], Dec. 7, 2021, partially amended.
10) Chodang University Flight Education Center Education Regulations, Article 6, 2021.09.

Table 1. Curriculum department and flight time

Course discrimination		Training hours and duration
A private pilot course		Department: 180 hours Flight: 60 hours
Instrument flight rating course		Department: 70 hours Flight: 40 hours
A commercial course		Department: 510 hours Flight: 150 hours
Pilot training certification course	Single	Department: 135 hours Flight: 25 hours
	Multi	Department: 135 hours Flight: 15 hours
Pilot rating limitation additional course	Single	Department: 20 hours Flight: 10 hours
	Multi	Department: 20 hours Flight: 10 hours

trainees who entered Approved Training Organizations (ATO), explaining the concept and the research purpose behind safety culture, including learning culture, and then examining results.

A 16-question measurement tool was developed based on Asa Ek (2006)'s Safety Culture in Sea and Approved Training Organizations (Kim, 2014; Asa Ek, 2004), having been modified and supplemented to meet the needs of a pilot training institution. In order to obtain statistics, 121 copies (89.6%) of 135 respondents were collected through a Google Questionnaire within 49 days from October 20, 2021, to December 7, 2021.

This study involved the following statistical processing of survey response data.

- · A frequency analysis was performed in order to analyze the demographics and sociological characteristics of the data that responded to the survey.
- · Reliability tests were conducted on the items to measure reliability between them to examine predictability and accuracy, and Cronbach's α was calculated for the reliability coefficient between items.

- · The level of differences between groups was examined using one-way ANOVA, which was confirmed by post-hoc analysis.

All statistical analyses were validated at a significance level of $p < .05$.

Ⅳ. THE RESULTS OF A STUDY

4.1 Demographic Characteristics

Out of a total of 135 respondents, 121 respondents (89.6%) were collected and analyzed for statistics. The distribution of respondents included the following: private pilot course 49 (40.4%), instrument flight certification course 42 (34.7%), business course 19 (15.7%), graduates, and general 9 (7.4%). As a result of the reliability analysis of the survey data used in this study, the Cronbach α value was 0.987, indicating that the data used in this study were reliable.

The survey Table 2 examined whether learning cultures and programs for promoting safety among student pilots were developed and implemented and whether related safety lessons were learned from safety incentives.

As a result of examining the level of perception of learning culture, it was relatively positive at an average of 3.75. The most active learning culture question is whether the application and development of flight skills and knowledge and the perceived risk to colleagues are the highest at 3.84, respectively, and whether safety campaigns conducted in all processes of flight are useful or valuable. As a colleague/ senior, have you encouraged each other to fly safely between each other in order to promote student pilot safety? The question was a bit lower at 3.63. The highest was 3.92. Thus, it can be concluded that safety education and promotion improvements are being carried out adequately.

As shown in Table 3, the difference in learning culture level by type between the four groups classified according to their jobs was analyzed as 3.83, the average of the private car

Table 2. Student pilot learning culture awareness level

Question	Mean	Std. Deviation	Variance
Education/training by course	3.81	1.44	2.07
Safety promotion behavior education	3.75	1.51	2.28
Willingness to improve safety promotion	3.72	1.47	2.16
Safety encouragement of leaders and colleagues	3.82	1.51	2.28
Encouraging leaders and colleagues for safety application and development of flight skills and knowledge	3.84	1.40	1.96
Safety lessons for managers, colleagues, and seniors	3.73	1.45	2.10
Encouraging colleagues and seniors to promote safety	3.92	1.52	2.31
Training and flight training in a safe way	3.81	1.50	2.25
School interest in safety issues arising during education and flight	3.69	1.52	2.31
Value of safety promotion in all areas	3.63	1.47	2.16
The importance of safety education for leaders	3.72	1.57	2.46
Recognition of risk factors for education and flight practice	3.80	1.51	2.28
Propagate to perceived risk colleagues	3.84	1.57	2.46
Familiarize yourself with how to use safety-related equipment	3.48	1.49	2.22
Learning to promote safety	3.72	1.53	2.34
Overall average	3.75		

Table 3. ANOVA by student pilot course

Course	Frequency	mean	Std. Deviation	Degrees of freedom	F value	Significance probability
Private	49	3.83	1.28			
Instrument	43	3.65	1.41	Between groups = 3		
Commercial	20	3.80	1.53	Between samples = 119	3.56	0.00
Graduate & general	9	3.73	1.49	Within group = 14		
Total	121	3.75	1.43			

course, 3.65, the average for the commercial course, and 3.73. Accordingly, based on the results of this survey, private car courses, commercial courses, graduates and the general public, and instrumental courses demonstrated the highest level of learning culture.

To determine whether the average value for each course is a numerical difference or is statistically meaningful, a variance analysis was conducted to determine the overall value of the test statistic F is 0.00 and $p<0.05$. This suggests that at a 95% confidence level, each course has a significantly different level of awareness of education and learning culture consciousness.

4.2 Analysis of Course-Specific Survey Items

According to the GAIN program's "Individual Safety Survey Tool", degrees of consent or opposition are measured on a 5-point scale, and the higher the total score of 125 points (25 paragraphs × 5 points), the better the safety culture rating. An average score of 93 points is generally considered to be the minimum level of an organizational learning culture. Consequently, fewer improvements need to be made. Weak learning culture 25-58, bureaucratic safety culture 59-92, positive learning culture 93-125 (Gain, 2001).

A safety survey tool provided by the GAIN program was utilized in this study to convert 5 to 125 points into 1 to 5 points for each item. The points ranged from 1 to 2.32. A weak learning culture was defined as 2.33 to 3.71, a bureaucratic learning culture was defined as 3.72 to 5, and a positive learning culture was defined as 3.72 to 5. Based on the assumptions used in the analysis, we found that there were no items at the weak level. However, there were three items for the bureaucratic level and the remaining 12 items for the positive level.

Factor 1: Organizational interest in safety issues arising during practice and flight
Factor 2: Value of safety promotion in all areas
Factor 3: Familiarize yourself with how to use safety-related equipment

First, improvement in learning.

An Approved Training Organization must continue to provide safety education and training from flight entry to the completion of the program. The chief executive officer must be aware of safety concerns. Pilots should be trained so that a learning culture can be systematically established, and safety managers must receive safety management training and collect relevant information and cases. Therefore,

Table 4. Factor analysis of bureaucratic learning culture items

Item	Learning	Promotion
Organizational interest in safety issues arising during practice and flight	.881	.396
Value of safety promotion in all areas	.879	.403
Familiarize yourself with how to use safety-related equipment	.416	.910

Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization.

safety learning needs to shift from theoretical learning, such as a simple listing of safety-related statistics in the past, to case studies-based education and learning. Additionally, safety scenario education and practice must be improved for various situations (Kim, 2014). Pilot students should be encouraged periodically and consistently to incorporate existing theories and the most up-to-date case studies associated with this learning. Moreover, safety managers or instructors tasked with safety education should continually collect relevant information and cases. In order to become experts in safety, they should study and acquire these skills. By using lecture techniques and education that convey safety-related knowledge and skills, safety learning activities can be supported at each level.

Second, raise awareness of safety promotion activities. A pilot does not experience accidents simply because the instructor is knowledgeable and technically competent when conducting flight education, so mind skills are invariably required in various situations (air safety hazards, aviation safety disorders, quasi-accidents, accidents, etc.). Thus, a comprehensive understanding of theoretical and situational awareness must be maintained for an organization in which all school members are involved in flight to promote safety. Recognition of situations through such learning enables individuals and flight-related organizations to conduct highly reliable safety promotion activities through daily safety checks and supervision. The improvement of safety education, learning, and awareness from the private car process of entering the first flight training center to the business process will make the business process more aware of safety issues.

V. CONCLUSION

A learning culture for promoting safety among students who begin to fly for the first time in professional educational institutions has

so far been explored. Learning and education cannot solve all safety-related problems, but a positive learning culture must be instilled in the safety management system from the top down, in order to initiate safety promotion activities. The Flight Education Center must recognize policies, management, guarantees, and promotion through safety philosophy, as well as the roles and responsibilities of students and leaders in safety management.

Additionally, as described in the previous paragraph, early education is very significant in all fields of education. The teaching safety can establish a strong awareness of safety promotion activities. Based on the results of the bureaucratic factor analysis survey, it was found that items related to familiarity with safety-related equipment, the importance of safety promotion across all areas, and the organization's interest in safety issues during training and flight were the most commonly reported items. Aviation safety programs are currently being developed and implemented by professional educational institutions.

In addition to reporting systems for aviation safety data and aviation safety information, it also includes safety objectives, safety organizations, aviation safety disturbances, and aviation safety operations. A safety indicator for aviation safety risk management is selected, trends are monitored, mitigation measures are implemented, change management is conducted, and self-safety audits are conducted. Despite the systematic education that is provided to promote safety, there are deficiencies in the above and it is necessary to continue making efforts to compensate for these deficiencies.

Finally, the safety promotion of all aviation workers as well as the training of flight instructors requires early education and continuous education that reflect an organization-wide culture of education and learning. It is necessary to ensure the systematic development and promotion of aviation safety education programs in institutions that train pilots, as well as to conduct in-depth follow-up studies of similar programs in other educational institutions.

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