



Research on Mediating Mechanism of Psychological Health and Professionalism of Civil Aviation Pilots

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Abstract. Psychological health problem and professionalism of pilots has brought hidden dangers for aviation safety. To explore mediating mechanism of psychological health and professionalism of pilots, data of civil aviation pilots respondents was collected through questionnaires, which including psychological health, locus of control, affective self-regulatory efficacy, and professionalism. In addition, according to the "Norms for the Cultivation of Professional Style of Crew Members" issued by the Civil Aviation Administration, the company records of the external behavior of pilots' professionalism were searched. The collected data was analyzed by mediating effect analytical method. Results show that locus of control of pilots have significantly negative correlations with affective self-regulatory efficacy and professionalism, while affective self-regulatory efficacy has a significantly positive correlation with professionalism. However, the correlations of external behavior of pilots' professionalism with internal-external control, affective self-regulatory efficacy, professionalism and psychological health are insignificant. The mediating effects of affective self-regulatory efficacy in the relationships between internal-external control and professionalism and psychological health are significant. These results indicated that pilots who generally attributed the outcome of the event to themselves and felt more in control of their stress tended to be more confident in their emotional regulation abilities, and because of their greater affective self-regulatory efficacy, they exhibited better mental health and professionalism. Moreover, the scientific validity of corporate behavioral records of external behavior of pilots' professionalism needs to be further investigated. Research results can provide references to conduct training methods of civil aviation pilots.

Keywords: civil aviation pilots, psychological health, locus of control, affective self-regulatory efficacy, professionalism, mediating mechanism

1 Introduction

Recently, the anti-epidemic measures and frequent quarantine under the influence of normalized epidemic control in China as well as the significantly decreased income and

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personal saturation brought by decreased flights have led to unprecedented impacts to psychological health of civil aviation pilots. On one hand, these impacts can induce a series of psychological health problems, such as depression, anxiety, fear, symptoms of stress, and so on. On the other hand, they can influence safety operation of pilots indirectly and brings hidden dangers to aviation safety. There's an air crash of Flight No.350 of Japan Airlines in 1982, an air crash of Silk Air in 1997, and an air crash of Germanwings in 2015. All of these air crashes show catastrophic consequences caused by psychological health problems of pilots. The 5.14 Event of General Administration of Civil Aviation of China in 2018 reflected the strong psychological ability of pilots to resist pressure, which became the example of pilots with excellent psychological competency.

Bandura (1986), a psychologist, proposed a social cognitive theory¹. He deemed that human behaviors are influenced by both external environment and internal cognition, and there are interactions among behaviors, cognition and environment. Some empirical studies have found that cognitive factors of human, such as risk perception and safety attitude, have interactive influences with safety atmosphere of external working environment, thus influencing unsafe behaviors of individuals. Based on social cognitive theory, the unsafe behaviors of pilots are influenced by internal cognitive factors of individuals and external working safety environment together. Locus of control expresses the control degree that individual believed over the event result and it is a kind of core self-evaluation. The internal-control individuals usually attribute events to themselves and have more control over pressure. The external-control individuals often blame for external factors, such as destiny and luck. According to previous research results, internal-control individuals often can cope with more pressure and have better psychological health level. External-control individuals are easier to be trapped in negative evaluation on themselves due to perception of out-of-control over the external world, and make more avoidance behaviours, thus causing more pains²³.

In China's civil aviation, professionalism of pilots are defined as steady attitudes and behaviors of pilots during production and operation, especially psychological cognition and external responses to various codes of conducts that guide and regulate safety production and operation. Some studies on professionalism and psychological health of pilots have been reported. Freedman proposed the definition of safety attitude. Safety attitude refers to the psychological tendency of individuals toward a specific event, concept or other people, which is composed of cognitive tendency, emotional tendency and behavioral tendency⁴. Yasuhisa Nagayama, a Japanese scholar, argued that the safety attitude refers to the psychological tendency to safety under the premise of respecting life⁵. Strasser et al. believed that safety attitude influences professionalism directly and they pointed out that people's attitudes help people to control activities and decide whether they can make safe responses to a specific environment⁶. With references to western studies, Ji Ming et al. compiled multidimensional criterion measurement for the non-technological skill safety evaluation by combining actual flight conditions of Civil Aviation Administration (CAA) of China⁷. According to flight operation analysis and literature review, Jiao Shenlin divided flying conducts into responsibility, attention to details, teamwork and dedication in the index evaluation system of

pilot competence characteristic model. Among them, responsibility influences the flying conduct the mostly 8.

The relationship between professionalism and safety attitudes of pilots has been analyzed in above studies, but there are few studies on the relationship between professionalism and psychological health of pilots. This study investigated potential influencing mechanism of the effects of locus of control on professionalism and psychological health of civil aviation pilots based on associated data, aiming to provide references to improve conduct competence and psychological health level of pilots.

2 Data Acquisition of Psychological Health and Professionalism of Pilots

2.1 Research Objects

A questionnaire survey was carried out to pilots in an airline company. In December, 2023, a total of 153 pilots aged from 22 to 31 (averaging at 24.91 and the standard deviation was 1.60) were invited to finish the questionnaire survey. All respondents were males. Data about psychological health, Locus of Control, self-efficacy and professionalism of pilots was collected in December, 2023.

2.2 Research Tools

2.2.1 Psychological Health Measurement

The psychological health problems were surveyed according to the List of 90 Symptoms compiled by Derogatis (1975)⁹. This questionnaire covers 10 dimensions, namely, somatization, obsessive-compulsive symptoms, sensitivity to interpersonal relationship, depression, anxiety, hostility, terror, paranoid, psychosis and others. It contains 90 items and uses the 5-point scoring (1 means no symptom and 5 expresses serious symptom). In this study, the coefficients of internal consistency (Cronbach α) of 10 different dimensions are 0.91, 0.88, 0.89, 0.92, 0.89, 0.84, 0.84, 0.83, 0.87 and 0.79, respectively.

2.2.2 Locus of control measurement

Locus of Control are usually measured by Rotter's Locus of Control Scale (LOCS)¹⁰. Different from other questionnaires, the LOCS applies the forced-choice method and 23 items are enlisted into the total score. The higher score indicates that individuals are more apt to external control, while the lower score means individuals are more apt to internal control.

2.2.3 Affective Self-Regulatory Efficacy Measurement

The general self-efficacy scale (GSES) compiled by Schwarzer et al. in 1981 is often used to measure affective self-regulatory efficacy. Wang Caikang et al. (2001) have translated it into Chinese and found its good reliability and validity. In specific self-

efficacy, affective self-regulatory efficacy has a high correlation with psychological health. Chinese researchers have formed the affective self-regulatory efficacy scale by revising foreign questionnaires [1].

2.2.4 Quantitative Evaluation of Professionalism

Based on Standards for Professionalism Training of Air Crew published by CAA, a total of 25 items about professional conducts of pilots were compiled to evaluate their reverence to life and regulations, their consciousness of honesty and trustworthiness, their scientific and rigorous professional knowledge as well as behaviors violating rules and regulations. Pilots were evaluated in four levels (4-point scoring) by managers and instructors of the company: “Failed”, “Qualified”, “Excellent” and “Model”. The total score is 100. The higher score indicates the better external behavior of pilots' professionalism of pilots.

Moreover, a professionalism self-evaluation scale of pilots was compiled according to descriptions of qualities and values of pilots in the Standards for Professionalism Training of Air Crew. The scale has 10 items and uses 5-point scoring, where 1 represents Strongly Disagree and 5 represents Strongly Agree. The higher score indicates the better professionalism of pilots in self-evaluation. Cronbach α of the compiled scale is 0.95.

3 Data Analysis of Psychological Health and Professionalism of Pilots

3.1 Mediating Effect Analysis Methods

The collected data was analyzed deeply by using Bootstrap in mediating effect analysis methods. The basic idea of Bootstrap is to make random sampling with replacement of existing data. In this way, new sample sets were generated and a statistical analysis was carried out to understand distribution characteristics of estimations.

Major steps include following aspects:

(1) Repeated sampling from the original data samples was performed and each sampling was random. Repeated sampling was allowed to generate new samples.

(2) Calculate statistical variables according to new samples, such as mean, median, variance, and so on.

(3) Repeat the above sampling and calculation of statistical variables for many times to assure stability and reliability of results.

(4) Summarize and analyze the generated statistical variables, thus getting distribution characteristics of data.

3.2 Data Analysis

Descriptive statistics and correlation analysis of Locus of Control, affective self-regulatory efficacy, professionalism and psychological health were carried out by using SPSS 22.0. Secondly, a structural equation model was built by using Lavaan package

in R 4.2.2. The mediating effect and significance were analyzed. The analysis results of structural equation model were visualized by using the lavaanPlot package.

3.2.1 Correlation Analysis Between Basic Psychological Needs and Working Style of Pilots

Descriptive statistics and correlation results of variables are listed in Table 1. Clearly, internal-external control has significantly negative correlations with affective self-regulatory efficacy ($r = -0.47, p < 0.01$) and professionalism ($r = -0.39, p < 0.01$), while affective self-regulatory efficacy has a significantly positive correlation with professionalism ($r = 0.80, p < 0.01$). Nevertheless, external behavior of pilots' professionalism has no significant correlations with internal-external control, affective self-regulatory efficacy, professionalism and psychological health.

Based on above analysis results, pilots with higher external control ability have the poorer affective self-regulatory efficacy and professionalism, and the pilots with poor emotional regulation ability also have poor professionalism. It is important to note that professional ethnics of pilots recorded by the company and assessed by managers have no significant correlations with psychological state.

Table 1. Descriptive statistics and correlation analysis ($N = 150$)

Variables	1	2	3	4	5
1. Internal-external control					
2. Affective self-regulatory efficacy	-0.47**				
3. Professionalism	-0.39**	0.80**			
4. External behavior of pilots' professionalism	-0.05	-0.16	-0.06		
5. Psychological health	0.22**	-0.14	-0.08	0.07	
<i>M</i>	7.38	73.25	45.75	59.46	76.68
<i>SD</i>	4.46	8.70	4.37	2.58	44.33

Note: 1) ** $p < .01$, hereinafter the same.

3.2.2 Mediating Effect Analysis of Affective Self-Regulatory Efficacy

A structural equation model was built by using locus of control as the independent variables, affective self-regulatory efficacy as the mediating variable, psychological health and professionalism as the dependent variables, and age as the control variable.

The analysis results of structural equation model are listed in Table 2. Obviously, internal-external control can predict affective self-regulatory efficacy significantly. Pilots with better internal control have the better affective self-regulatory efficacy. Moreover, affective self-regulatory efficacy can predict professionalism and psychological health significantly. In other words, affective self-regulatory efficacy can mediate relations of internal-external control with professionalism and psychological health.

The significance of mediating effect was further analyzed by Bootstrap method and 1,000 sampling was carried out repeatedly. Results are shown in Table 3. The mediating

effect of affective self-regulatory efficacy in the relationship between internal-external control and professionalism is 0.40 and the confidence interval excludes 0. This reveals that affective self-regulatory efficacy has significant mediating effect in the relationship between internal-external control and professionalism. The mediating effect of affective self-regulatory efficacy in the relationship between internal-external control and psychological health is 0.53 and the confidence interval excludes 0. This proves that affective self-regulatory efficacy has significant mediating effect in the relationship between internal-external control and psychological health. As show in figure 1.

Table 2. Mediating effect analysis of self-esteem in the relation ship between basic psychological needs and professionalism

Variables	Independent variables	β	SE	z
Mediating variable: affective self-regulatory efficacy	Internal-external control	-1.02	0.15	6.74***
	Internal-external control	-0.01	0.08	-0.17
Dependent variable: professionalism	affective self-regulatory efficacy	0.39	0.04	9.99***
	Age	-0.19	0.18	-1.09
	Locus of Control	-0.01	0.45	-0.03
	affective self-regulatory efficacy	-0.51	0.24	-2.17*
	Age	-1.49	0.68	-2.20*
	Dependent variable: psychological health			

Table 3. Significance analysis of mediating effect and total effect

	Estimations	Boot stand-ard error	Boot CI Lower limit	Boot CI Upper limit
Mediating effect 1 (internal-external control-affective self-regulatory efficacy-professionalism)	-0.40	0.06	-0.51	-0.28
Total effect (internal-external control-affective self-regulatory efficacy-psychological health)	0.53	0.25	0.09	1.06

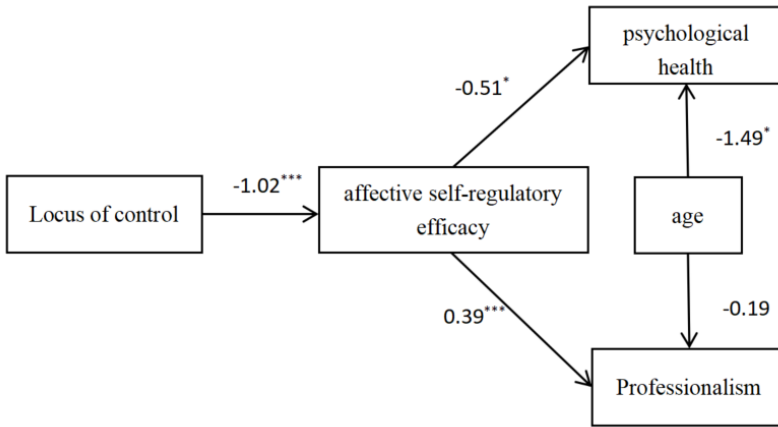


Fig. 1. Mediating effect of affective self-regulatory efficacy in the relationship between psychological health and professionalism of pilots

4 Discussions

In this study, psychological health, internal-external control, professionalism and affective self-regulatory efficacy of pilots were investigated. Results show that the locus of control of civil aviation pilots is closely related with professionalism and psychological health. Besides, affective self-regulatory efficacy can mediate the relationship between locus of control and psychological health as well as professionalism of civil aviation pilots. However, no significant correlation was existed in external behavior of pilots' professionalism recorded in the company and other variables of this study.

Firstly, this study found that pilots' professionalism is closely related to locus of control. Specifically, internally controlled pilots showed better professionalism. Pilots who believe their fate is in their own hands also seem more willing to accept the inherent spirit of the requirements of the pilot position. This shows that in the process of pilot training, individual efforts and inner strength should be valued. Importantly, influenced by internal professionalism, pilots will show more excellent safety performances and make fewer ultra-limit events¹².

Nevertheless, it is worth of noting that this study hasn't recognized a significant correlation between psychological health of pilots and external behavior of professionalism recorded in the company and assessed by managers. This might be because existing evaluation of professionalism mainly concentrates in records of work style. In daily management, some behaviors violating rules and regulations without consequences are difficult to be recorded and evaluated. Hence, professional ethnics recorded in the company and assessed by managers are difficult to be evaluated accurately and objectively.

Secondly, the influencing path of locus of control of civil aviation pilots on professionalism as well as psychological health was further explored. It was found that effect

of affective self-regulatory efficacy has some mediating effect. Better emotion regulation self-efficacy can prevent individuals from being troubled by negative emotions¹³. Among pilots, the more internally controlled they are, the more likely they are to have good emotional regulation, cope better with daily work stress, and demonstrate superior professionalism and mental health.

Research results can provide some enlightenment to safety behavior management of pilots in civil aviation. Safety is the lifeline of civil aviation. Pilots are key posts of safety and their professionalism are crucial to safety guarantee. Nevertheless, it cannot ignore that psychological state of each pilot as an ordinary individual deserves concern and attention. The industry and company have to establish a psychological support system of pilots to guarantee their psychological state meeting airworthiness requirement continuously.

This study still has some limitations. Firstly, pilots involved in this study are relatively young. Whether research conclusions can be promoted to older pilot instructors and captains has to be further investigated. Secondly, this study is a cross-sectional study and causal relationships among variables cannot be investigated completely. In future, a longitudinal study can be designed to further explore the relationship between psychological health and professionalism as well as the mediating effect of internal-external control. Finally, this study finds that affective self-regulatory efficacy plays potential mediating effect, indicating there's other interaction mechanism between psychological health and professionalism of pilots. This requires further explorations.

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References

1. Bandura, A.. (1986). From thought to action: mechanisms of personal agency. *New Zealand Journal of Psychology* No, 1(3), 807-810.
2. Mahnaz, S., & Carmel, F. (2014). The relationship between mental health components and locus of control in youth. *Psychology*, 5(8), 966-978.
3. Roddenberry, A., & Renk, K. (2010). Locus of control and self-efficacy: Potential mediators of stress, illness, and utilization of health services in college students. *Child Psychiatry and Human Development*, 41(4), 353-370.
4. Hou Yubo. *Social Psychology* [M]. Beijing: Peking University Press, 1979:15-20.
5. Liu Junmin. Effects of Drivers' Safety Attitudes on Travelling and Training of Safety Attitudes [J]. *Road Traffic and Safety*, 2004(1), 6-8.
6. Zhen Liuyu. Research on the Relationship between Safety Attitude and Driving Styles of Drivers [D]. Liaoning Normal University, 2016.
7. Ji Ming. Research on Flight Safety Performance Evaluation based on Airline Driving Behaviors [D]. Shaanxi Normal University, 2008.
8. Jiao Shenlin. Research on Competency Characteristic Model of Pilots in Civil Aviation [D]. Civil Aviation University of China, 2019.

9. Derogatis, L. (1975). How to Use the Symptom Distress Checklist (SCL-90) in Clinical Evaluation: Psychiatric Rating Scale, Vol III, Self-Report Rating Scale. Nutley, NJ: Hoffmann-La Roche.
10. Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80(1), 1-28.
11. Wang Y J, Dou K, Liu Y. (2013). Revision of the emotional regulation self-efficacy scale. *Journal of Guangzhou University: Social Sciences Edition*, 12(1), 45-50.
12. WANG Yonggang, MA Wenting. (2023). Influence of pilots' driving skills, flight style and self-efficacy on safety performance. *Journal of Safety Science and Technology*, 11, 180-187.
13. Hai, M., Qin, Q., Xiong, J. M., & Wu, H. (2019). Cross-Lagged Analysis of Relationship between Affective Self-Regulatory Efficacy and Mental Health in Adolescents. *Journal of Psychological Science*, 42(1), 82-87.

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