

# The Classroom Curriculum Development for National Aviation Security Instructor

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## Abstract

The study aimed to identify the objectives related to the National Aviation Security Instructor Curriculum (NASIC), employing Outcome-Based Education (OBE) principles and the ADDIE (Analysis, Design, Development, Implementation, Evaluation) Model, and to evaluate the effectiveness of the NASIC implementation. The methodology included mixed research methods, both quantitative and qualitative, utilizing three rounds of Delphi surveys to determine the competencies of National Aviation Security Instructors (NASI). The development of NASIC was based on the analysis of expert opinions, utilizing various criteria such as positive coefficient, concentration of opinions, expert authority coefficient, and expert coordination coefficient. This process resulted in the identification of 33 competencies for NASIs. To evaluate the effectiveness of the curriculum, an experiment was conducted, involving both an experimental group and a control group. The study ensured there were no significant baseline differences between the two groups concerning demographics and background variables. The evaluation of the curriculum's effectiveness was carried out across three dimensions: knowledge, skills, and attitudes. Statistical analysis, including Chi-square tests and Mann-Whitney U tests, was performed on the data collected from both groups. The results indicated statistically significant differences between the experimental and control groups across all three areas of knowledge, skills, and attitudes, suggesting that the NASIC implementation had a positive impact. These findings provide a framework for future research in applying OBE concepts and the ADDIE model to other aviation curricula.

**Keywords:** National Aviation Security Instructor; Outcomes-Based Education; Curriculum; ADDIE Model; Delphi Technique

## Introduction

Terrorism threatens the security of all humanity and is a great threat to global peace. The terrorist turned civil aviation airliners into "killer bombs" in the events of 911. Because of the enormous impact of attacks on civil aviation, it has become a target for terrorist attacks, as a result of recent international media coverage of terrorist attacks at airports, there is greater awareness of the risks posed by terrorism to flight and the need for security measures in the aviation industry (Shahrabani & Regev, 2019).

In China, the terrorist threat situation in civil aviation remains critical. On 29 June 2012, six terrorists violently hijacked a flight GS7554 from Hotan, Xinjiang, to Urumqi, China, injuring some passengers and crew members. In addition to the damage caused by terrorist attacks, there are other causes of security incidents that have caused serious damage to civil aviation. Thus, the effective training of aviation security personnel has become essential.

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The previous national aviation security instructor course was designed based on the traditional curriculum design method, and the course design was based on the training objectives set by the experts, and the emphasis was on the training process and the implementation according to the training plan, but not on the results of the students' learning, which caused a big difference between the training and the students' abilities needed in civil aviation security positions, and the training effect was not recognized by the airports and airlines as employers. Therefore, this research plans to adopt the Outcomes-Based Education (OBE) concept to design a national aviation security instructor curriculum. OBE is important and is used in higher education curriculum development. This is because OBE concept emphasizes the outcomes of student learning. By designing programs that begins with the final learning outcomes of the students and setting course objectives, course specifics, lesson plans, teaching methods, and assessments based on outcome needs, OBE is an important concept for changing educational outcomes and producing an advanced workforce with specialized knowledge (Yanawongsa, Intasingh, Nguenyuang, & Intanet, 2020). Due to the OBE concept, the curriculum is designed with emphasis on the learning outcomes of the trainees and their competency in the job after training. The curriculum is designed based on the competency as well as the knowledge, skills and attitudes of the aviation security instructors required, which can ensure the job competency of the trainees in the job after training to a large extent, which is also consistent with the requirements of ICAO and China for in-service personnel training.

The national aviation security instructor course design concept determined to be based on the OBE concept, so what curriculum design model should be chosen to implement the OBE course design concept? After studying among many curriculum design models, the researcher selected ADDIE curriculum design model because it is a curriculum design model that is very much in accordance with the characteristics of civil aviation courses. In addition, there were few studies on OBE that were integrated with the ADDIE curriculum development model.

ADDIE model originated in the 1970s. The model designed for Florida State University for in-service training of military personnel; it was slowly being used in other areas of education or training (Bamrara & Chauhan, 2018). The model is a model for educational design (Nevzorov, 2021). ICAO developed courses based on a development method that is based on the theory that trained personnel acquire competencies through training, using the ADDIE course development model, which is commonly applied by ICAO in the development of training courses and is also generally accepted by civil aviation countries (Huang, 2017). The NASIC design in this research followed the ADDIE curriculum design model was also in line with the ICAO curriculum design requirements, and was a bold attempt and application of the ADDIE concept to the Chinese civil aviation curriculum.

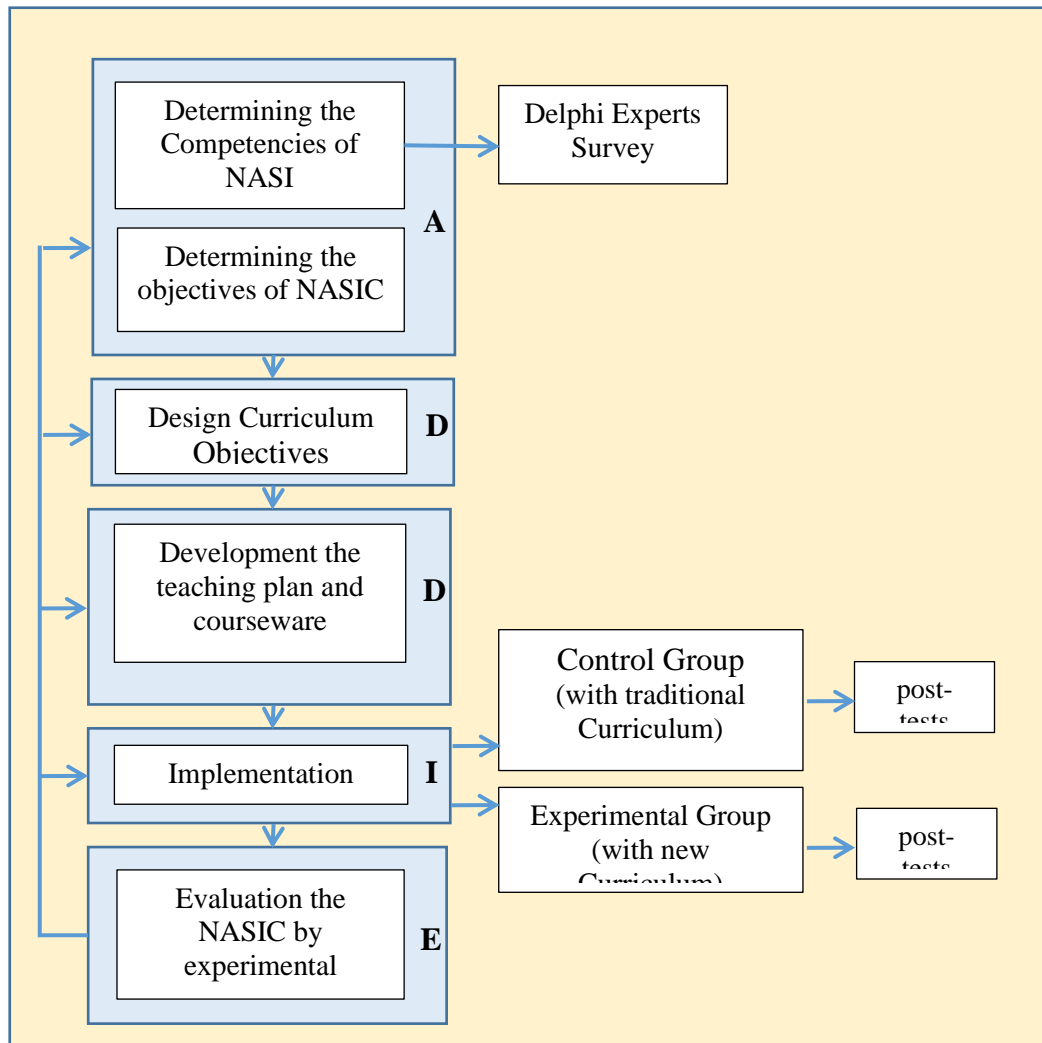
## Research Objectives

This research has three objectives.

1. To identify the objectives of the National Aviation Security Instructors Curriculum.
2. To develop the National Aviation Security Instructor Curriculum.
3. To evaluate the effectiveness of the National Aviation Security Instructors Curriculum implementation based on OBE concepts.

## Research Methodology

The researcher used a mixed-method to answer the research questions. The Delphi method was used in the analysis phase of curriculum. The experimental method was used in the evaluation phase of curriculum. The procedure of the study is shown in Figure 1.



**Figure 1** Flow diagram of the Research Procedure

In this study, the experimental design involved two groups: experimental and control group. The experimental group were given curriculum which differed from those given to the control group. The experimental group was trained with the curriculum developed in this study, and the control group was trained with the traditional version of the NASIC.

The methodology included one post-experimental assessment for both groups. The three dependent variables were knowledge, skill and attitude. Knowledge was measured using the NASIC Theory Examination. Skill was measured using the NASIC Skill Examination. Attitude was measured using the NASI Attitude Questionnaire.

## Research Scope

### *Participants*

The population of this study are the NASI of around 2,000 instructors in China. A sample size of 128 was calculated using the G\*Power version 3.1.9.7, by setting the input and output parameters. They were randomly assigned to each group.

### *Instruments*

In this research, four research instruments were used. They were Delphi Survey Questionnaire, NASIC Theory Examination, NASIC Skill Examination, and NASI Attitude Questionnaire. Delphi Survey Questionnaire was used in the curriculum development phase and the other three instruments were used in the curriculum evaluation phase. All instruments were passed the Index of Item-Objective Congruence check which meant that these instruments reflected reasonable content validity. The Cronbach's  $\alpha$  of NASI Attitude Questionnaire is very good.

### *Data Collection*

The data collected in this study consisted of data collection at the analysis phase and the evaluation phase of the curriculum. The data collected in the analysis phase of the curriculum consists of three round by Delphi Survey Questionnaires. The data collected in the evaluation phase of the curriculum consists of one post-test by NASIC Theory Examination, NASIC Skill Examination, and NASI Attitude Questionnaire.

### *Data Analysis*

The data were analyzed using SPSS software version 23 and MAXQDA software. The data were collected from the Delphi Survey Questionnaires consisted of quantitative and qualitative data. For quantitative data, a descriptive statistical analysis were used to describe the statistic values. To justify the reliability and scientific validity of the Delphi survey, Positive Rate, Expert Authority Coefficient (Cr), Coefficient of Variation (CV) and Kendall's concordance coefficient (W) were reported. For qualitative data, MAXQDA software were used to analyze comments.

For demographic data, a descriptive statistical analysis used to describe the basic statistic values. Meanwhile, the comparisons of the demographic characteristics between the intervention and control groups at baseline were examined using Chi-square test for categorical variables. The data collected from the NASIC Theory Examination, NASIC Skill Examination, and NASI Attitude Questionnaire are quantitative data. The Mann-Whitney U test was used to analyzed the data from the experimental and control groups. The Z value, p value, median, quartile, extremes, pass rate were reported.

## Research Findings

### *Delphi method*

Expert Positive Coefficient: In each of the three rounds, questionnaires were distributed to 18 experts, and the effective recovery rate was 100.00%.

Expert Authority Coefficient: The results of Cr Value of Round 1, 2, and 3 are 0.906, 0.925, and 0.934, and the results are reliable.

Concentration of expert opinions: In this study, the degree of concentration of expert opinion is represented by the mean (Mj) and the full score frequency (Kj).

Experts coordination coefficient: The results indicating that there is a significant consistency among expert opinions. The CV value is the ratio of the Standard deviation to the Mean.

Boundary Value: In round one, the boundary values of the full score frequency, mean and CV were 51.09, 4.384, and 0.182. In round two, the boundary values of the full score frequency, mean and CV were 30.955, 4.216, and 0.148. In round three, the boundary values of the full score frequency, mean and CV were 24.247, 4.199, and 0.14.

Selection of indicators: In the three rounds of expert consultation, 5 items were deleted, 3 items were modified, and 3 items were added.

#### *Experimental method*

Demographic analysis: 128 NASI trainees as participants originally provided data. The Chi-square tests showed that there were no significant baseline differences between groups based on age ( $\chi^2 = 0.283$ ,  $p = .868$ ), years of work ( $\chi^2 = 0.148$ ,  $p = .929$ ), educational background ( $\chi^2 = 1.073$ ,  $p = .585$ ) and gender ( $\chi^2 = 0.567$ ,  $p = .451$ ) categories.

Post-experimental analysis. For the post-test scores (NASIC Theory Examination, NASIC Skill Examination, and NASI Attitude Questionnaire), a non-parametric Mann-Whitney U test was used for analysis.

The Mann-Whitney U Test results showed that the NASIC Theory Examination scores between two groups that there were statistically significant differences ( $Z = -4.335$ ,  $p = 0.000$ ). The Mann-Whitney U Test results showed that the NASIC Skill Examination scores between Experimental and Control Group that there were statistically significant differences ( $Z = -4.091$ ,  $p = 0.000$ ). The Mann-Whitney U Test results showed that the NASI Attitude Questionnaire scores between Experimental and Control Group that there were statistically significant differences ( $Z = -3.977$ ,  $p = 0.000$ ). The median, quartile, and extremes of scores for the Experimental group (20, 19~22) and Control group (18.5, 17~21).

## **Discussion**

This research explored the development of NASIC based on the OBE concept, combined with the ADDIE curriculum development model, and validated the effectiveness of NASIC training in China. This study developed NASIC by combining the OBE concept and the ADDIE curriculum development model and evaluated the training effectiveness of the developed NASIC.

The concept of OBE centers on student final learning outcomes, making it a valuable tool in curriculum design. This educational concept is widely recognized for its role in facilitating the realization of training effects. Numerous scholars, such as Anderson & Krathwohl (2001) and Bloom et al. (1956), have conducted similar studies, highlighting the significance of OBE in education. The OBE concept plays a crucial role in setting curriculum objectives with direction and precision. It contributes significantly to achieving training outcomes by guiding the curriculum design process. Numerous scholars have conducted studies emphasizing the importance of OBE in determining curriculum objectives, yielding consistent research findings (Zhang et al., 2021; Malan, 2014; Bloom, 1968). Previous studies and participants have consistently highlighted the significance of the OBE-based concept in curriculum design, emphasizing the importance of identifying outcomes resulting from curriculum implementation and reverse-engineering curriculum objectives based on these outcomes (Weimer, 2013). This study followed a similar approach. The study findings indicate

that curriculum objectives designed in this manner align with the training curriculum's requirements and ensure the realization of training outcomes.

This research, being based on the OBE concept, emphasizes the necessity of aligning curriculum design with participants' post-training outcomes. Considering the positive role of the OBE concept highlighted by several previous scholars in identifying objectives and defining curriculum outcomes in curriculum design, it is both reasonable and advisable for this study to develop the NASIC based on the OBE concept.

In this study, the Delphi technique was used in this study to determine the competencies that NASI should have after training and the Delphi technique is a very well-established technique for determining the competencies of personnel. Many scholars have previously applied the Delphi technique to determine the abilities of different groups of people and have come to very reliable conclusions (Wakefield & Watson, 2014; Landeta, 2006). Many later scholars have used the Delphi technique in the field of education with equally good results, agreeing that the Delphi technique is a mature and adaptable research methodology (McPherson, Reese & Wendler, 2018; Asselin & Harper, 2014). This study is in the area of determining the competencies of personnel in the field of education, so the application of the Delphi technique is very appropriate.

The second core element based on the OBE concept is learner-centeredness. Towers listed the necessary conditions for OBE to work: the first, it must be clear what students are to learn. The OBE concept was to first determine the desired outcome before developing a course, and to design the course based on the outcome (Fitzpatrick, 1995). Therefore, this study followed the learner-centered approach to determine what competencies learners need to achieve after training before developing the curriculum and then determine the objectives of the curriculum based on competency needs. Therefore, the curriculum content developed in this study based on the OBE concept is in line with the learning needs of the training and is able to meet their job competency requirements.

Compared to curriculum designed with traditional methods, curriculum designed with the OBE concept is more relevant and more focused on the results after the implementation of the curriculum. Curriculum designed based on the OBE concept make outcomes more measurable and more focused on the achievement of results. Many scholars have also demonstrated through research that the OBE concept is advanced compared to traditional methods of designing curriculum. Scholar Jessup argued that education or training is defined by outcomes and that the OBE concept opens up access to learning and assessment in ways that are not possible in traditional education. Many of the problems faced in traditional education and training can be solved by OBE if learning is targeted by outcomes (Harden, 2007).

Experimental results showed that the training effect of NASIC developed based on the OBE concept is significantly higher than the training effect of curriculum developed in the traditional model. This is consistent with the results expected before the research was done. NASIC developed based on the OBE concept showed higher performance in terms of knowledge, skills and attitudes of the trainees than the traditional curriculum training. It is also more in line with the three areas of knowledge, skills, and attitudes required of NASI's positions. This is the significance of this study, which is to find a curriculum that training outcomes are more in line with the requirements of the NASI position in order to improve the effectiveness of the training. Therefore, the results of the study showed that the curriculum developed based on the OBE concept is more effective.

The results of this curriculum design were able to meet expectations, and the ADDIE curriculum development model that was used played a big role in that as well. The role of the ADDIE model of curriculum development in this study is basically the same as the significance of the research on the ADDIE model by various scholars mentioned. As Gonzalez (2022) suggested, the results of the ADDIE model, whether used alone or in conjunction with other models, are significant. Hamamah et al. had also studied the effects of combining the ADDIE model with the OBE concept (Hamamah et al., 2020). However, their study was in the field of writing assessment, which proved significant results, but not in the field of curriculum development, so this study is innovative in combining the ADDIE model and the OBE concept in the field of curriculum development. This study combined the ADDIE model and the OBE concept to develop NASIC, and the results after the implementation of the program are also consistent as the results of the previous scholars' studies. This study combined the ADDIE model with the OBE concept to improved NASIC training outcomes in line with NASI job competencies. Therefore, this study proves that the combination of ADDIE and OBE concepts is also of positive importance in the field of curriculum development, which is conducive to enhancing the effectiveness of curriculum development and ensuring that the effectiveness of the training is in line with expectations.

## **Recommendations**

Presented are the curriculum development recommendations for a National Aviation Security Instructor, focusing on Academic, Policy, and Practical aspects. Academic Recommendations: Ensure the curriculum covers comprehensive aspects of aviation security, integrating recent research and using case studies to illustrate concepts from diverse disciplines like psychology and engineering; Policy Recommendations: Teach instructors about international and national aviation security regulations, develop their policy analysis skills, emphasize ethical considerations, and design the curriculum to adapt to evolving security policies; and Practical Recommendations: Provide hands-on training in security techniques, conduct simulation exercises for real-world scenarios, familiarize instructors with current security technologies, and foster collaborations with industry experts for practical insights and networking.

There are three suggestions for future research. First, Expanding the Scope of Application: While this study focused on developing the NASIC, future research can extend the application of the combined OBE concept and ADDIE model to develop other aviation courses. Second, Diversifying Participant Groups: Although NASIs were the primary participants in this study, future research could explore the impact of the combined approach of the OBE concept and the ADDIE model on the training effectiveness of different aviation staff groups. Third, Increasing Sample Size and Duration: Given the constraints of time and resources in this study, future researchers are encouraged to select larger experimental samples and extend the duration of the experiment.

## **Conflict of Interest**

There was no conflict of interest or unethical behavior between the research content and the current organization during the research period.

### Ethical Certification

To ensure proper ethical standards which are required for publication, the research proposal was submitted to the Rangsit University Ethics Review Board for consideration. Approval was granted and a certificate # RSUERB2022-131 was issued on December 15, 2022.

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