Journal of Aviation/Aerospace Education & Research

Volume 6
Number 3 *JAAER Spring 1996*

Article 2

Spring 1996

Determination of Curriculum Content for a Non-Engineering Doctoral Degree in Aviation

Robert W. Kaps

DETERMINATION OF CURRICULUM CONTENT FOR A NON-ENGINEERING DOCTORAL DEGREE IN AVIATION

Robert W. Kaps

The U.S. aviation industry has been and continues to be a rapid-growth sector of commerce. Educational and academic metamorphosis coincident with this growth is evident in the number of postsecondary educational institutions offering degrees in aviation. A recent publication of the Collegiate Aviation Guide (UAA, 1994a) listed more than 500 postsecondary institutions offering aviation programs. More than 200 are at the baccalaureate level or higher. Many, established in the past 10 years, coincide with the net industry growth rate.

Despite a proliferation of undergraduate institutions and a growing number of institutions at the graduate level offering degrees in aviation-related fields, no university in the United States offers a doctoral degree devoted solely to aviation. Recent studies (Baty, 1985; Johnson, 1993; Johnson & Lehrer, 1995; NewMyer, 1987; Rollo, 1990) have determined and legitimized the need for an aviation doctoral program. Lacking, however, has been a study to determine curricular content.

Using what the author defines as a re-modified Delphi procedure, 11 senior executives across the aviation spectrum were interviewed to obtain industry-specific curricular needs. Upon completion of this procedure, interview information was combined, collapsed, and reviewed. Using a keyword search methodology, common themes and curricular specificity were identified. This process resulted in 34 curricular components.

Employing a Likert scaling system, a two-round Delphi questionnaire was constructed and sent to two independent expert panel groups. Panel makeup consisted of the original industry professionals and a comparable size panel of University Aviation Association (UAA) practicing educators. Considering group mean and standard deviations, each identified curricular component as inclusive, excluded, or questionable.

Comparison of the two groups provided combined consensus of core components of International Politics, Current Issues in Aviation, Research Methods, Intermodal Transportation Studies, Corporate Law, Advanced Accounting Procedures, Applied Research, and an industry-specific Internship. Areas of potential specialization components also were identified.

BACKGROUND

The United States has long been a pioneer and leader in the worldwide aviation community. This status is a result of sustained excellence in science and technology, in part created and supported by higher education. This leadership role is now being threatened by foreign competitors who continue to make inroads into a number of sectors of the industry. According to Johnson (1993), representatives from education, government, and industry believe that the United States may lose the leadership role in aviation. Obviously, leadership in the aviation sector is partly dependent on professional education opportunities for pre-service and incumbent workers. Experienced people should be developed for leadership positions in the industry and in academic programs that serve it.

Just as the aviation industry has evolved into a complex enterprise (Adamski & Doyle, 1993), aviation education programs (Johnson & Lehrer, 1995) now exist in many technical schools, colleges, and universities throughout the United States. Bachelor's degree programs in aviation are offered by scores of large universities. In recent years, baccalaureate and graduate programs have been established to meet the increasing demands of industry and government. Despite proliferation of undergraduate programs and growing numbers of graduate degrees, there is no terminal or professional degree in aviation. According to the authors of a recent funding proposal for study of a doctorate of aviation degree, educators charged with delivering aviation subject matter do not have preferred credentials. In a grant proposal to the Fund for the Improvement of Post Secondary Education (FIPSE), the UAA declared:

> The ability of higher education to meet industry demand is constrained by lack of faculty with requisite aviation and academic credentials. At a time when an earned doctorate is a requirement for entry level tenure track positions, less than 16% of the aviation professors possess the doctorate. (UAA, 1994b, p. 2)

Eighteen years ago, the American Council on Aerospace Education (1977) defined the need for aviation and aerospace education:

> When we consider that in the United States alone a half million people board commercial airlines on a typical day; or that scheduled airlines this past year carried well over 200 million people -- the equivalent of the entire U.S. population; or that there are nearly 200,000 general aviation aircraft, 13,000 airports, and some 700,000 pilots; or that there are nearly one million people employed in the aerospace industry; or that aviation and space play a vital role in our national security; or that our aerospace foreign trade balance, which was $7.8 billion last year, was 70% of the total U.S. trade balance; or that the exploration and exploitation of space are benefiting mankind in so many more ways than anyone thought possible, then we begin to understand the sociological and technological importance of an aviation and space education. (p. 4)

Aviation has evolved into one of the more resilient segments of the U.S. economic base. According to NewMyer and Kaps (1995), a 6.5% average industry growth rate occurred during the last 10 years. Specifically, from 1985 to 1995 employment in the industry (exclusive of military aviation) grew from 2,074,190 to 2,209,644 employees. These numbers include: aerospace manufacturing; the air transport sector; major, national, regional, and commuter airline operations; general aviation (i.e., smaller corporate, business, and personal aircraft operators and fixed base operators); and aviation-related government agencies. Examples of the latter groups are the Federal Aviation Administration (FAA), the National Transportation Safety Board (NTSB), airports, and related planning organizations and associations. This net positive growth occurred despite massive consolidation in the air transport, aerospace, and airframe manufacturing sectors, and the virtual cessation of piston-engine general aviation manufacturing activity.

Emerging global market dynamics have caused the aviation industry to elevate entry-level employment qualifications for both engineering and non-engineering personnel. Many employers require degrees in addition to aviation certification for entry-level positions. A Future Aviation Professionals of America (FAPA) publication (1990) reported that in recent years 94% of new-hire pilots employed by major and national airlines hold baccalaureate or higher degrees. Certification alone was deemed sufficient for most positions only a few years ago. For many positions, employers prefer business knowledge and training, language and communications skills, and fundamental knowledge and understanding of the broader socio-economic global system of which the aviation industry is a major element.

Profound changes are taking place in the aviation industry. Privatization, globalization, and liberalization in the form of reduced government regulation are placing challenging demands on industry managers as they strive for improved productivity, quality, and profitability. This new market environment, coupled with massive financial losses, has forced air carriers and airframe manufacturers to redefine core business objectives and reshape their workforce to reflect and support these objectives. Although these sectors remain highly specialized, task-oriented environments, economic and political realities of

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

the global marketplace have fixed premiums on individuals with interdisciplinary training. In the past, candidates with in-depth preparation in aviation and only functional literacy in the disciplines of business and economics were acceptable. This is no longer true. The new operating environment requires candidates with balanced, in-depth preparation in both aviation and core business functions. A two- or three-course business subspecialization is no longer adequate preparation for managers in the dynamic, global market environment. A survey (Johnson & Lehrer, 1995) conducted among collegiate aviation educators to define subject matter in aeronautical/aerospace programs indicated a strong need for business and business-related subjects. The demand for well-trained, internationally competent middle managers with solid business and aviation preparation is at a crucial state. According to the International Air Transport Association (1993):

> ... to successfully compete, aviation firms must have senior managers who deal with risk and change as opportunities. These managers must be conversant with emerging technology and at the same time understand the essence of modern leadership and the vital role of human resources. There is now, and will increasingly be, an acute shortage of such well-trained senior air transport management staff in many countries. Recent worldwide surveys of university management education have pointed to the urgent requirement for "specific" high level programs designed for the unique global problems of individual industries. (p. 2)

Strickler (1986) indicated that there is movement toward an integrated transportation system in this country and throughout the world, in which all modes of transportation will be coordinated and integrated for efficiency and economy. Tomorrow's expert must know ground, rail, sea, and air transportation and their interrelationships. Persons who will be challenged to supply the energy, talent, and knowledge to sustain the industry into the 21st century are already in the educational system.

Aviation programs in postsecondary educational institutions have expanded beyond flight and airframe and powerplant traditions. Many colleges and universities now offer curricula that focus on preparing entry-level personnel for non-technical positions in the industry.

The educational and academic transformation paralleling rapid industry growth is evident in the number of postsecondary educational institutions offering degrees in aviation. In 1975, 287 (FAA) postsecondary institutions offered courses in non-engineering aviation specializations. In 1982, the Aero College Aviation Directory (Mandis, 1984) listed 400 aviation programs throughout the United States, an increase of 39%. Fifty of these were baccalaureate non-engineering offerings (Mandis, 1984). More recently the Collegiate Aviation Guide (UAA, 1994a), listed more than 500 postsecondary institutions offering aviation programs. More than 200 of those programs are at the baccalaureate level or higher. Many collegiate aviation programs have been established in the past 10 years, coinciding with the net positive industry growth rate. The need to meet industry demand for high-quality educational offerings led aviation institutions in 1988 to develop an aviation education specific accrediting body, the Council on Aviation Accreditation (CAA).

Despite these implicit commitments to curricular integrity, relevancy, and improvement demonstrated by the UAA, the CAA, and individual member institutions, explicit commitment to appropriate preparation of faculty has fallen behind. There are not enough educators qualified to support program offerings aligned with the emerging globally dynamic industry (UAA, 1994b). Aviation and related fields are one of the largest non-agrarian users of human resources (DOT, 1989). Adequate preparation of college graduates and the faculty who teach them is essential in maintaining the leadership role of the United States in global aviation. In 1969, California Governor Ronald Reagan spoke of the need for aviation professionals:

> We need those who have a high degree of familiarity with many aspects of aerospace-aviation, and who can blend aviation into an integrated system to accommodate movement. For movement is the essence of modern communication and the

exchange of ideas. ... What is required is quality in education, delivered by those competent to impart the knowledge. (Reagan, p. 6)

As the discipline of aviation grows and the need for graduate education increases, the need for qualified faculty also increases. Because an important object of a doctoral program is to facilitate a communication of purpose between scholars and practitioners in a discipline (Lopez, 1961), establishment of a non-engineering aviation doctoral program could enhance aviation faculty members' understanding and purposes of the aviation field. By conducting research and developing intellectual competencies, graduates of aviation doctoral programs may contribute to the development of the aviation field. Because technical research is an essential ingredient of industrial competitiveness (Cheng, Elckhoff, Gedeon, & Sinn, 1986), a doctoral degree program in aviation may be an appropriate vehicle not only for aviation scholars but also for aviation practitioners and industry leaders.

Discussion

Aviation education is rooted in knowledge from many academic and technical disciplines. Taylor (1990) found that the market for persons with degrees in aviation offers not only traditional flight and mechanic positions, but also jobs with a much broader range of consulting firms, government agencies, universities, and a large variety of aviation and aerospace institutions. Because of the spectrum of needs, aviation education must address an array of problems and processes while providing knowledge from many disciplines. Curriculum must be interdisciplinary if it is to fulfill its professional performance role. Johnson and Lehrer (1995) found that 52% of aviation educators perceived needs for business management, human factors, research, and other interdisciplinary subjects. Advanced degrees should, therefore, emphasize application of analytical skills from fields such as political science, law, economics, statistics, computer information systems, business administration and management, and elements of other social sciences.

In recent years, several factors coalesced to make the delivery of effective, efficient, responsive, and equitable educational programs more complex. First, there has been an explosion of technological change, most apparent in electronic data processing and information systems. Toffler (1980), Naisbitt (1984), and others have documented the coming requirements fostered by profound Information Age shifts. These advances have afforded greater opportunity for establishing more effective and efficient programs. Academicians are required to apply state of the art management skills to maximize usefulness of technology developments.

Second, profound social changes have helped groups previously excluded from aviation -- African-Americans, Hispanics, American Indians, and women -- to gain access to and advancement in the aviation profession. Given cultural, political, and other differences between these groups and most aviation administrators and educators, strains have been created. Thus, skill in dealing with divergent viewpoints should be a consideration of advanced curricula.

Third, new approaches to aviation administration have emerged in areas such as yield management, budgeting, public finance, planning, personnel management, inter-governmental relations, policy analysis, program evaluation, and marketing.

Finally, and partly in response to the changes outlined above, a proliferation of legislative and judicial directives has altered the aviation environment. These legal changes include, but are not limited to, affirmative action guidelines, employee stock ownership programs, rulings on airport and airline environmental protection issues, general aviation product liability reforms, noise abatement, safety standards, and workforce education requirements.

STATEMENT OF THE PROBLEM

Four studies of aviation education substantiated the need for doctoral programs in aviation. The tertiary domain examined institutional educational preferences of aviation educators (Baty, 1985); the evolution of and the need for a first professional degree in aviation (NewMyer, 1987); the evolution of aviation education programs (Rollo, 1990); and the perceptions of aviation educators on the need for an aviation doctoral program (Johnson, 1993). Each has added to the body of knowledge of degree structures in aviation. These studies established that the preferred educational level for university aviation educators is the doctorate. Missing from each of these

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

studies, however, was discussion of objectives and content areas; that is, basic parameters for such programs. Although previous research has demonstrated that doctoral programs are desirable, little research has been conducted on professional aviation educators' opinions about curriculum essentials. Cooper (1986) identified the problem facing higher education in establishment of a doctorate of aviation:

> One of the perennial problems which has not yet been seriously addressed is the absence of a common knowledge base for all students who would take a doctorate in higher education. This is unlike most of the doctoral programs in other disciplines in which there is an agreed upon list of courses and seminars which every such student is expected to pass. (p. 9)

In her 1990 dissertation, Rollo concluded:

> Professional aviation is an emerging field not yet fully recognized throughout higher education. I see it emerging as did other schools such as medicine and business some years ago. Its emergence will be resisted but in the end, it will happen. There will be slow acceptance, followed by cooperation across disciplines. (p. 90)

Each of these four authors limited inquiry to members of the UAA. Thus, there is a dearth of research literature on other persons' perceptions of aviation education. This scarcity may be due either to a lack of academic recognition of the discipline as a legitimate field of inquiry by researchers outside the aviation education community or to narrow foci of researchers in the aviation education community. Although the membership of the UAA is best suited to determine the ultimate structure and content of degree programs, practicing aviation professionals should supply much of the basic data sets; e.g., emerging issues and major barriers the aviation industry will confront in coming years. Articulation of such concerns into curricular content may provide foundation for industry support. Although some may argue that responding to labor, managerial, or industry curricular needs creates market-driven education and somehow diminishes the value of higher education, the goal of education is to prepare individuals for a productive workforce (Levine & Boyer, 1985), and to prepare individuals in critical analysis and appreciation (Rosovsky, 1990).

If the curriculum of a non-engineering doctorate of aviation program is carefully designed to reflect the needs of the aviation industry, doctoral graduates may be better prepared to educate technical and managerial industry personnel and to contribute to the development of the aviation field through their technical and scholarly research. From these considerations it follows that a doctoral degree in aviation may be needed to prepare faculty and industry active personnel for the discipline of aviation.

PURPOSE OF THE STUDY

The purpose of this study was to gather suggestions of aviation professionals on content for a doctorate in aviation and then to seek consensus perceptions of aviation professionals and aviation educators on the same subject. Specifically, the study identified views of a group of industry professionals and practitioners about content of a doctorate in aviation. These views then were evaluated by industry professionals and aviation educators. To conduct the study, a Delphi consensus-building technique was employed. The following research questions were addressed in this study:

1. What are the emerging issues and the technological, demographic, social, psychological, economic, legal and/or major barriers the aviation industry will confront in the next 10 years?

2. In light of these issues and barriers, what knowledge base, skills, or curricular needs are essential for study at the doctoral level in aviation to facilitate and maintain the position of the United States as the aviation industry world leader?

METHOD

Two types of descriptive research methods were used: personal key informant interviews and parts of the modified Delphi technique. This methodology deviated from the standard and modified Delphi technique in that the researcher interviewed a group of panel participants, derived curricular statements from these interviews, created a Delphi questionnaire, and then surveyed original participants and a concomitant group to ascertain consensus in and between groups. This remodified Delphi procedure formed the basis of this research.

First, personal key informant interviews were conducted with a group of aviation industry professionals. These interviews generated a list of aviation industry curriculum statements for inclusion in a doctoral degree program in aviation. This method (Weaver, 1988) offers an enlarged support base for the program in social and industrial communities, and permits collection of relevant and timely data.

Second, a modified Delphi instrument designed by Dalkey and Helmer (1963) and revised by Delbecq, Van deVen, and Gustafson (1975) was developed using the curriculum statements from the key informant interviews. The primary objective of Delphi inquiry is to obtain consensus opinion from a group of respondents (Rojewski & Meers, 1991; Salancik, Wenger, & Helfer, 1971). Delbecq et al. stated: "Delphi is a group process which utilizes written responses as opposed to bringing individuals together" (1975, p. 83). The Delphi procedure used in this study parallels the research of Brooks (1979), Helmer (1967), Linstone and Turoff (1975), and Wicklein (1992). The modified Delphi instrument was distributed to the aviation professionals and to a selected group of aviation educators to determine perceptual consistency and relevancy.

Research Methodology and Design

Key informant interviews were conducted with a group of 11 industry professionals in senior management positions to gain their insights into aviation-related curricular matters (Mueller, Schussler, & Costner, 1977). As outlined by Campbell (1955), the key informant interview method is more than a sampling technique, it is an explicitly formalized research methodology.

This strategy was chosen for two reasons. First, as was suggested earlier, several studies have been completed in and among the aviation academic community on the need for the doctoral degree program in aviation. However, aviation industry representatives at large have not been surveyed to determine their views on content and perceived need for candidates possessing such a degree. Secondly, without external evaluation such tightly bound research creates a vested interest by the aviation education community in continuing existing aviation curricular offerings.

Key Informant Selection

Wolfe and NewMyer (1985) described the aviation industry as consisting of six segments: aviation manufacturing; airlines (major, regional, and commuter); airports; fixed base operators; corporate flight departments; and airmen. Adamski and Doyle (1993) included government regulatory and legislative processes, and Truitt (1995) further defined government to include federal and state government aviation agencies such as the Department of Transportation and state regulatory bodies.

Personnel selected to participate in key informant interviews were drawn from each of the industry segments defined above. The industry groups, numbers selected, and vague identification of the individuals for interview were: (a) aviation manufacturing (two representatives: a chairman of the board and a president); (b) airlines, broken down by major, regional, and commuter (three representatives: all presidents of their organizations); (c) airport administration (one major airport administrator, director of one of the largest 15 FAA defined in terms of traffic); (d) fixed-base operations (one major operator, president); (e) airmen (president of major national union); (f) government (head of a federal government agency and a representative of the State of Illinois Aviation arm); and (g) corporate aviation (chief pilot for a transnational corporation).

Seven aviation segments were represented and 11 individual interviews were needed. A smaller sampling or a different research tool would not be an appropriate method to examine the complex interrelationships that exist in aviation, but a key informant technique is ideal for such purposes (Rhea & Shrock, 1987). Ideally, according to John and Reve (1982), the key informant technique should include only one participant from each of a relatively limited number of organizations.

Sample Selection

Selection of each professional was based on recommendations by responsible and reputable members of the education and aviation communities. Selection of the

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

sample in this manner was reflective of the "snowballing" technique in which an individual with certain characteristics can best identify others with similar qualities (Bogban & Biklen, 1982). Success of the key interview technique relies on informed opinion, so random selection was not considered. The professionals selected are considered to be well-informed, leading authorities in their fields by their colleagues, superiors, and peers, and by virtue of their positions in the aviation industry.

After identification, each professional was contacted to determine willingness to participate. To preserve process integrity, freedom of expression, and anonymity, no participant was apprised of the name or affiliation of other participating members.

Scope of Interviews

The interview format generally followed the strategy and procedure outlined by McMillan and Schumacher (1989). Each industry professional was asked to respond to the two open-ended questions; both questions were considered to be within the scope of the professional's expertise. Following standard procedures for semi-structured interviews, the investigator probed and added more specific questions as appropriate (Gordon, 1987).

The intent and design of the first question was twofold. First, to establish rapport and to allow the interviewee to display the proper attitudes toward the subject matter contained in the ultimate question on curriculum. According to Benjamin (1981), to obtain the maximum amount of information in the interview:

> We should stop after we have indicated the purpose of the interview and furnished the information, if any, we intend to give. The interviewee will usually have a great deal to say if he/she feels we are ready and willing to listen to him [*sic*]. If we want a conversation, good communication, we shall see to it that the interviewee has the opportunity to express himself fully. (p. 14)

Additionally, Gordon (1969) indicated that a lead-in question need not be directly relevant to the object of the interview, but rather, can serve the function of effectively leading the interviewee to a relevant question area in a way that prepares for more accurate and valid information.

Secondly, responses to question one would be useful in determining areas of operational concerns, rationale, and topics that would bear directly on the subject of the primary question on curriculum. McCracken (1990, p. 40) stated that the successful interviewer must give respondents "plenty of room" to talk and they must be allowed to "go" wherever they wish if reliable information is to be obtained. The object of the interviewer, according to Guion (1981), will always be to integrate the totality of information available.

Nature of the Key Informant Interview

Due to the national scope of the participants' homes and jobs, all interviews were conducted by telephone. Each interview was limited to 30 minutes. To minimize risk of mistakes in the taking, transcription, interpretation, and extrapolation of handwritten notes, the interviewees were asked to permit tape recording. The more complex the information, the less the method should depend on the interviewer's memory (Gordon, 1987). The more rapid the flow of relevant information the less dependence should be placed on taking longhand notes.

If a professional had reservations about recordings, the researcher was prepared to take handwritten notes. Interviews were conducted during May, June, and July of 1995.

Analysis of Interview Data

Upon completion of all interviews, transcriptions were made, recorded, and placed into individual document files. The individual files also were condensed into two major files, the first containing the operational concern responses identified in question one, the second containing specific curriculum component responses identified in question two.

Curriculum component responses generated by question two were extracted from the combined question two file and grouped according to comparable subject matter. These grouped subject matter listings then were used as a keyword list to analyze and extract interview data from question one for recurring words and associated themes (Berelson, 1971). Industry professionals identified 145 curriculum areas. Because no individual was aware of other participants, and because of the open-ended interview format, many suggestions overlapped. Overlap also occurred in some individuals' suggestions. This result was expected because of the nature of the information discussed and the interview procedure.

All suggestions were grouped in comparable subject matter areas. If two or more respondents made similar suggestions, a generalized description was prepared for inclusion in the subsequent Delphi survey. Descriptors resulted from the range of responses to question one. These descriptors were amalgamations of keywords and phrases in responses. Thus the specific curriculum suggestions elicited by question two were augmented by the keywords and phrases elicited by question one. Amalgamation resulted in 34 curriculum identifiers and statements. These were the basis of Delphi questionnaires of Round 1 and Round 2.

The 34 curriculum statements were not mutually exclusive (**Table 1**). Some might have been combined. However, because the intent of the research was to reveal thematic perceptions of practicing aviation professionals and aviation educators of statements of industry leaders, avoiding overlap was less desirable than ensuring that all keywords and phrases were retained in recognizable form.

Delphi Questionnaire Design

The Delphi questionnaire consisted of the 34 curriculum statements followed by a ranking mechanism. Each statement contained a curriculum component title and a brief description followed by a Likert scale.

Respondents were instructed to rank the importance of each curriculum statement using a five-point Likert scale. The Delphi questionnaire contained no open-ended questions that allowed respondents to justify or elaborate their rankings. Kaufmann and English (1979) suggested that a prepared list of items may erode the creativity of the panel; however, a prepared list does provide comprehensive data when validated by expert opinion.

Delphi Questionnaire Validity

The Delphi questionnaire was tested by five aviation educators for content validity, clarity of instructions, and research focus. This method followed the procedure outlined by Ary (1985) to:

> ... have competent colleagues familiar with the purpose examine the items to judge whether they are adequate for measuring what they are supposed to measure and ... whether they are a representative sample of the behavior domain under investigation. (p. 357)

Primary concern centered on the validation of the meaning of all terms used and document format and style. According to Best and Kahn (1986), the meaning of all terms must be clearly defined so that they have the same meaning to all respondents. Larry Bailey (personal communication, October 1992) suggested that the presentation and appearance of the survey device is important to both validity and reliability.

Respondents indicated that they understood the questionnaire's intent. Several commented on overlap of statements in several categories and indicated that three could be combined: Labor Relations, Personnel and Employment Management, and the Railway Labor Act. To better preserve industry input, and based on the enormity of the content areas, the researcher determined that the suggestion was not valid. Other responses of the test group indicated that the Delphi instrument was valid.

Selection of Delphi Panel Members

Two Delphi panels were used to evaluate the 34 curriculum statements on the questionnaire.

The first Delphi panel consisted of the 11 industry professionals who participated in the key informant interview process and whose collective, anonymous comments were the source of the Delphi survey questions. Each of these individuals represented a unique and identifiable sector of the aviation industry. Therefore, these individuals were given the Delphi survey questionnaire to determine whether curriculum statement consensus existed across the unique aviation industrial sectors they represented.

The second Delphi panel was drawn from the UAA, which broadly represents the practicing body of the aviation education community. To maintain consistent levels of educational expertise in this panel, only those familiar with studies on doctoral programming were identified as potential panel members. Balaraman and Venkatakrishnan (1980) stated that when evaluating or investigating professional curricula, a panel must be drawn from those in similar professions. The selection of

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

Table 1
Industry Panel Curriculum Suggestions

CURRICULUM	COMPOSITE DESCRIPTION
Air Traffic Control	Procedures, methodology phraseology, and impact of privatization, etc.
Aircraft Performance Specifications	Course designed to identify and understand capacity and capabilities of modern aircraft
Airline Management	Understanding of operational environment, yield management systems, break-even analysis, load-factor analysis, etc.
Airport Management	Study of airport operations with emphasis on political aspects of community involvement and governmental relationships
Applied Research	Research requirement (dissertation) related specifically to aviation subject
Aviation Law & Regulation	An examination of both international and domestic laws, treaties, and regulations with special emphasis on FAR's and ICAO
Aviation Policy & Planning	Focus on federal aviation policy and planning with emphasis on key aviation policies and policy-making process
Civil Engineering	Training in design and construction of public works projects (e.g., airports)
Comparative Economic Systems	Understanding of capitalism, communism, and socialistic structures, and realities of operating under each system
Contemporary Governments	Study of political systems and policy issues of various governments, with emphasis on European Union and Pacific Rim countries
Corporation Law	Understanding of fiduciary relationships, equity positions, stockholder rights, bankruptcy positions, and ESOP's
Current Issues	Examination of broad aviation topics, issues, and research in aviation field
Environmental Protection	Emphasis on noise, water, and air pollution controls and requirements
Financial Accounting Concepts	Basic concepts, principles, and techniques used in generation of accounting data for financial statements
Foreign Language Proficiency	Foreign language proficiency requirement for doctorate
Foreign Trade	Theory of international trade and its relationship to aviation
Intermodal Transportation	Study of all aspects of transportation impacting the aviation community
International Finance	Financial behavior of multinational firms and modification of conventional models to incorporate uniquely foreign variables
International Politics	Analysis of the concepts of international political behavior with special emphasis on bilateral agreements, cabatoge, alliances, and other factors affecting aviation
International Trade & Finance	Understanding of world trade, currency exchange, banking systems, and capital flows

Table 1, cont.
Industry Panel Curriculum Suggestions

CURRICULUM	COMPOSITE DESCRIPTION
Internship	Practical experience in an aviation industry related field
Labor Relations	Elements of both domestic regulations and international labor policies
Leadership/Managerial Behavior	Emphasis on managerial effectiveness at middle and upper organizational levels
Macro Economic Theory	Study of economics in terms of whole systems, especially with reference to general level of output and income
Micro Economic Theory	Theory of the organization, market structure, and theory of the consumer
Multinational Marketing Management	Elements of marketing management identified in the setting of the global business environment
Organizational Theory/Development	Examination of various principles and practices underlying the corporate structure
Personnel/Employment Management	Overview of the field of personnel administration with emphasis on both domestic and international requirements
Railway Labor Act	Course in understanding of unique application of airline labor relations and procedures
Recurrent Internship	Candidate, in order to maintain aviation industry proficiency, must periodically serve time in an industry capacity
Research Methods	Development of research competencies and methodology
Security Methods	Course designed for airport, aircraft, and airline security proficiency
Statistical Measurement and Interpretation	Emphasis on descriptive statistics and graphical interpretation of data
Tourism	Examination of components of the travel industry, market segments, demographics, and motivators

experts (Leide, 1977, p. 171) should have as its major consideration "their professional competence." Because of their background and responsibility, those identified are sensitive to major barriers that must be overcome to advance program articulation activities. Thus only those possessing doctoral degrees were selected for participation. This is consistent with Dalky's (1972) views for expert identification and with Pratt (1980), who wrote:

> The experts whose assessment of the curriculum is sought need to be knowledgeable ... be willing and encouraged to deliver a candid judgment ... There is something to be said for having an assessment by disciplinary experts and curricular generalists. (p. 410)

Institutional and individual members of the UAA were identified through the January 19, 1995, membership roster. A cadre of 109 potential panel members who possessed doctoral degrees was identified.

A 10% sample size was selected. This is consistent with Rowntree's (1941) contention that small sample size

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

reasonably approximates population characteristics when using random sample selection and with McMillan and Schumacher (1989), who stated that small sample size is appropriate for exploratory research and group comparison.

Using a systematic tabulation procedure (Hinkle, Wiersma, & Jurs, 1988) every eleventh registered individual was selected from a listing randomly arranged using a computer and a word processing system.

$$n/N = 11/109 = 1/11$$

Eleven potential participants were randomly identified. They were contacted to ascertain willingness to participate. They were not apprised of the names, locations, or academic affiliations of other participants. If a potential panel member declined, the above methodology was used again to select an alternate. The equation for subsequent selections was:

$$n/N = 11/109 - \# \text{ drawn} = 1/x$$

Data Collection

Because arrangements were made in advance with the industry professionals to participate in the Delphi part of the research and because each of the UAA members was contacted in advance of the Delphi probe to determine willingness to participate, a return rate of 100 percent was experienced and the mean time for receipt of all responses was under three days. (One participant required approximately 10 days to complete and return the mailed instrument.) All members of each panel responded to all questions in each round and the survey was completed in August 1995. All response data gathered from Round 1 and Round 2 were entered into two spreadsheet files. Round 1 and Round 2 responses were entered, by question, for all questions in each round.

Round 1

Simultaneously the Delphi Round 1 questionnaires were distributed via telephone fascimile to the 11 members of the industry panel and to 10 members of the education panel. Because the other education panel member did not have access to telephone facsimile, one questionnaire was mailed with a return self-addressed, stamped envelope. Each questionnaire contained a unique tracking number to allow the researcher to correctly prepare and administer the Round 2 survey instrument and maintain respondent anonymity.

Each of the 22 panelists was instructed to complete the Round 1 instrument rating each curriculum statement from one (1) "not important" to five (5) "very important" on a Likert scale. A sixth category, "don't know," was included should the panelist not be able, or choose not to, rank a curriculum statement. Likert scales were used to allow panelists to indicate the extent to which they believed a statement was important to a doctoral degree program in aviation.

Round 1 data were gathered from the industry and education panels and means and standard deviations were calculated.

Round 2

Distribution of the Delphi Round 2 questionnaire was accomplished in the same manner as Round 1. The Round 2 questionnaire contained the original questions and Likert scales distributed in Round 1. Each panelist's Round 1 ranking for each curriculum statement was superimposed for each of the 34 curriculum statements. In addition, the industry panel's Round 1 grouped mean for each question was indicated on industry panel Round 2 questionnaires and the education panel's grouped mean for each question was indicated on education panel Round 2 questionnaires. The tracking numbers on the Round 1 questionnaire ensured that each participant received the correct Round 2 questionnaire.

Round 2 data were gathered from the industry and education panels and means and standard deviations calculated.

Treatment of Delphi Data

Round 1 and Round 2 responses from each panel were collapsed and analyzed as grouped mean ratings. Each curriculum statement was evaluated for consensus among participants in each panel.

Consensus

To measure levels of consensus, Round 1 and Round 2 Likert mean scores were analyzed. Mean responses ranging from 4.0 to 5.0 were perceived as strong panel support for inclusion in a doctoral degree program. Mean responses ranging from 2.50 to 1.00 were perceived as strong panel support for exclusion from a doctoral degree program. Mean responses ranging between 2.51 and 3.99 were perceived either as uncertainty regarding the need

Table 2
Industry Panel Round 2 Response Distribution

Exclusionary Curriculum Statements	**Round 2 Group Mean**
Air Traffic Control	2.445
Uncertain/Diverse Curriculum Statements	**Round 2 Group Mean**
Civil Engineering	2.636
Aircraft Performance Specifications	2.909
Railway Labor Act	3.364
Airport Management	3.545
Organizational Theory & Development	3.636
Macroeconomics	3.636
Personnel & Employment Management	3.818
Foreign Language Proficiency	3.909
Contemporary Governments	3.909
Incusionary Curriculum Statements	**Round 2 Group Mean**
International Trade & Finance	4.000
Internship	4.000
Tourism	4.000
Environmental Protection	4.000
Leadership & Management Behavior	4.000
Comparative Economic Systems	4.000
Research Methods	4.000
Airline Management	4.000
International Finance	4.091
Aviation Policy & Planning	4.091
Microeconomics	4.091
Security Methods	4.182
Foreign Trade	4.182

for the curriculum statement or as extreme diversity of responses in the panel. Clason and Dormody (1984) indicated that the discrete ordinal nature of each Likert scale point permits summarization of responses as counts, percentages, or categories. Likert (1932) indicated that he never intended for the five-point response alternatives to be the scale. Thus categorization permitted blending of like or similar responses and splitting the "somewhat important" category scores above and below the mean.

Stability

Stability was determined by two methods. The first method consisted of a percentage of change in mean responses from Round 1 and Round 2 for each panel. Dajani, Sincoff, and Talley (1979) stated that "consensus is assumed to have been achieved when a certain percentage of the responses fall within a prescribed range" (p. 83). Miller (1970) indicated that change of less than 15% was an indication of stability. Therefore, based on Dajani et al. (1979), a change of less than 15% was determined to indicate stability.

The second method consisted of comparing the grouped standard deviations for Round 1 and Round 2 for each panel. A decrease in group standard deviation between Round 1 and Round 2 was a reliable indicator of stability and movement to consensus.

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

Table 2, cont.
Industry Panel Round 2 Response Distribution

Aviation Law & Regulation	4.182
Recurrent Internship	4.200
Labor Relations	4.273
International Politics	4.273
Multinational Marketing Management	4.273
Intermodal Transportation	4.273
Statistical Measurement & Interpretation	4.364
Applied Research	4.364
Financial Accounting Concepts	4.455
Corporation Law	4.455
Current Issues	4.727

Panel Comparisons

The final analytical step consisted of comparisons of Round 2 group mean responses of the industry and education panels. This analysis served to identify curriculum statements with strong positive or negative mean rankings indicating that both industry and education panelists favored inclusion or exclusion. This analysis also served to identify curriculum statements rated high by one of the Delphi panels and low by the other.

RESULTS

Analysis of Data

Completion of the Delphi rounds provides consensus relationships among different categories of curriculum. Based on standard deviation and mean observance, results fell into distinct categories. These consisted of those statements having high consensus for inclusion in a doctorate degree in aviation (Inclusionary Curriculum Statements), high consensus for not including in degree curriculum (Exclusionary Curriculum Statements), and those whose support appeared questionable (Uncertain/Diverse Curriculum Statements). Comparison and evaluation of the two panels are highlighted below.

Industry Panel

Consensus Stability

Twenty-nine of the 34 curriculum statements, or 85.3%, demonstrated increased Round 2 means. Only one Round 2 response (2.94%) experienced a decrease in its mean. The average percentage change for all curriculum statements from Round 1 to Round 2 was +3.64%, also well within the predetermined 15% stability level. Thus, mean stability was achieved in the industry panel. Reduction in average standard deviation indicated stability of consensus. The combination of standard deviation reduction and less than a 15% change in Delphi Rounds means indicates stability of consensus in the industry panel.

Industry Panel Response Distribution

Table 2 denotes industry panel Round 2 rankings for each curricular statement by rating range: inclusive, exclusive, and uncertain/diverse.

The industry panel response distribution cluster is pyramidal, with more statements identified for inclusion in a doctoral degree program in aviation than for either exclusion or uncertainty. Of the 34 curriculum statements, 70.59% were ranked for inclusion, 2.94% for exclusion, and 26.47% fell in the uncertain category.

Education Panel

Consensus Stability

Twenty-one of the 34 curriculum statements, or 61.8%, demonstrated lower Round 2 means. Ten Round 2 responses (29.4%) demonstrated increased means. The average percent change for all curriculum statements from Round 1 to Round 2 was -4.31%, well within the predetermined 15% stability level. Thus, mean stability was achieved in the education panel. As with the industry panel, reduction in average standard deviation indicated stability of consensus. Based on the combination of standard deviation reduction and less than 15% change

Table 3
Education Panel Round 2 Response Distribution

Exclusionary Curriculum Statements	Round 2 Group Mean
Civil Engineering	1.893
Macroeconomics	1.959
Air Traffic Control	2.107
Aircraft Performance Specifications	2.157
Foreign Language Proficiency	2.200
Tourism	2.455
Uncertain/Diverse Curriculum Statements	**Round 2 Group Mean**
Security Methods	2.529
Leadership & Management Behavior	2.529
Railway Labor Act	2.620
Comparative Economic Systems	2.818
Labor Relations	2.835
Microeconomics	2.909
Financial Accounting Concepts	2.934
Recurrent Internship	2.980
Personnel & Employment Management	3.107
Organizational Theory & Development	3.124
Aviation Policy & Planning	3.322
Corporation Law	3.322
Foreign Trade	3.372
Contemporary Governments	3.545
International Trade & Finance	3.570
Airline Management	3.595
International Finance	3.636
Airport Management	3.727
Multinational Marketing Management	3.818

in the means between Round 1 and Round 2, stability of consensus was affirmed in the education panel.

Education Panel Response Distribution

Table 3 indicates the education panel Round 2 rankings for each curriculum statement by rating range: inclusive, exclusive, and uncertain/diverse.

Distribution of the education panel responses takes on a diamond clustering shape with almost equal percentage distribution of exclusionary topics with inclusionary topics. Of the 34 curriculum statements, 17.65% were grouped as consensus for non-inclusion in a doctoral degree program in aviation, 20.59% for inclusion, and 61.76% fell in the uncertain category.

Delphi Panel
Comparative Findings

Inclusion consensus

Table 4 indicates those curriculum statements demonstrating statistically stable inclusion consensus in both Delphi panels. Both professional aviation panelists and aviation educators considered these curricular statements as definitely germane to the doctoral degree in aviation.

This category of subject matter holds commonality among both industry and education panelists. Indicative of this commonality is both a high correlation of mean scores and very low standard deviation among the panels. Very close and highly rated mean

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

Table 3, cont.
Education Panel Round 2 Response Distribution

Environmental Protection	3.818
Aviation Law & Regulation	3.909
Inclusionary Curriculum Statements	**Round 2 Group Mean**
International Politics	4.141
Statistical Measurement & Interpretation	4.207
Applied Research	4.496
Current Issues	4.450
Internship	4.587
Intermodal Transportation	4.637
Research Methods	4.934

scores were substantiated by similiar standard deviation of (.5873) for the industry panel and (.5620) for the education panel. The highest deviation occurred in International Politics in the education panel and Intermodal Transportation in the industry panel.

Exclusion consensus

Table 5 records those curriculum statements demonstrating stable exclusion consensus. Both Delphi panels were in consensus agreement, indicating curricula in this area should not be a topic for inclusion in the degree structure.

As with the previous section, the Air Traffic Control curriculum statement demonstrated consistency in both panels with corresponding low means and standard deviations indicating exclusion consensus. The deviations were (.535) in the education panel and (.688) in the industry panel. All survey participants were in agreement that Air Traffic Control, as identified, was not a topic for inclusion in a doctoral degree program in aviation.

Uncertainty consensus

Table 6 denotes those curriculum statements demon-strating uncertainty consensus in both Delphi panels. Each topic did not have enough positive or negative emphasis to either include or exclude from consideration.

Within this grouping several means are centrist due to extreme diversity of responses among the participants, some panelists leaning heavily toward inclusion, others toward exclusion. Others definitely belong in the uncertain classification by virtue of tight mean scores and low standard deviations. Each curriculum statement ranked by the education panel demonstrated high standard deviation, implying the mean is a result of varying degrees of diversity of choice.

The industry panel data show low standard deviation scores in Personnel and Employment Management and in Organizational Theory and Development, an indication

Table 4
Curriculum Statements Indicating Dual Inclusionary Consensus Ratings

Curriculum Statement	Education Panel Mean	Industry Panel Mean
International Politics	4.141	4.273
Statistical Measurement & Interpretation	4.207	4.364
Applied Research	4.496	4.364
Current Issues	4.545	4.727
Internship	4.587	4.000
Intermodal Transportation	4.637	4.273
Research Methods	4.934	4.000

Table 5
Curriculum Statements Indicating Dual Exclusionary Consensus Ratings

Curriculum Statement	Education Panel Mean	Industry Panel Mean
Air Traffic Control	2.107	2.445

of collective consistency toward the curriculum statement being "somewhat important." The remaining three curriculum statements demonstrated high standard deviations, indicating diversity in the selection process with some panelists ranking them higher than the "somewhat important" option. A review of the three curriculum statements indicated the Railway Labor Act contained three ratings of "very important" selected by the three airline representatives; the Airport Management curriculum statement had three ratings of "very important," ranked by the three participants with an airport history in their background; and the component of Contemporary Governments received similar ratings from individuals representing the airlines, government, and major manufacturing.

Each case of diversity in the industry panel is logical because those selecting higher than mean choices have definitive concern in the areas identified. The airlines must operate under the terms and conditions of the Railway Labor Act, and thus see it as a necessary ingredient to the doctorate. Similarly, airport management is a significant operation field and thus provides specialized data for the specialist. Lastly, the Contemporary Governments component was selected by a cadre of individuals whose operations require a knowledge of international operations. Although ranked in the uncertain category, these three topics have high inclusion correlation among the users of their subject matter. Thus such courses may be candidates for a field of specialization relating to a particular discipline such as airline, airport, and so on.

Divergent consensus

Table 7 indicates those curricular statements demonstrating statistically stable consensus differences between the two Delphi panels.

Education panel members agreed with industry panel members on 13 curriculum statements (38.2%) identified for inclusion, exclusion, or uncertainty relative to a doctoral degree program. The remaining 21 curriculum statements (61.8%) provide for interesting analysis. Of those 21 statements, industry panelists believed that the majority, almost 80%, belonged in the inclusion category. Conversely, the education panelists were more inclined to rate the same statements with less enthusiasm, placing 94.1% in the uncertain category. Tourism, cited for inclusion by the industry panel, was rated by the education panel in the exclusion category.

The industry panel identified the remaining four curricular statements (19%) as questionable or uncertain for inclusion in a doctoral degree program in aviation, while the education panel believed all four statements -- Foreign Language Proficiency, Aircraft Performance Specification, Microeconomics, and Civil Engineering -- should not be included.

SUMMARY

Analysis of industry panel responses revealed statistically stable Delphi consensus perceptions among the panelists.

Table 6
Curriculum Statements Indicating Dual Uncertainty Consensus Ratings

Curriculum Statement	Education Panel Mean	Industry Panel Mean
Railway Labor Act	2.620	3.364
Personnel & Employment Management	3.107	3.818
Organizational Theory & Development	3.124	3.636
Contempory Governments	3.545	3.909
Airport Management	3.727	3.545

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

Table 7
Curriculum Statements Indicating Consensus Differences Between Delphi Panels

Curriculum Statement	Education Panel Mean	Industry Panel Mean
Civil Engineering	1.893	2.636
Macroeconomics	1.959	3.636
Aircraft Performance Specifications	2.157	2.909
Foreign Language Proficiency	2.200	3.909
Tourism	2.455	4.000
Security Methods	2.529	4.182
Leadership & Management Behavior	2.529	4.000
Comparative Economic Systems	2.818	4.000
Labor Relations	2.835	4.273
Microeconomics	2.909	4.091
Financial Accounting Concepts	2.934	4.455
Recurrent Internship	2.980	4.200
Aviation Policy & Planning	3.322	4.091
Corporation Law	3.322	4.455
Foreign Trade	3.372	4.182
International Trade & Finance	3.570	4.000
Airline Management	3.595	4.000
International Finance	3.636	4.091
Multinational Marketing Management	3.818	4.273
Environmental Protection	3.818	4.000
Aviation Law & Regulation	3.909	4.182

Legend: No Shading indicates Exclusion Category; Medium Shading indicates Uncertain Category; Dark Shading indicates Inclusion Category.

Response distribution exhibited pyramidal clustering. Twenty-four curriculum statements (70.59%) were perceived to merit inclusion in doctoral programs, nine curriculum statements (26.47%) were perceived as uncertain inclusions, and one curriculum statement (2.94%) was perceived as excludable.

Analysis of education panel responses revealed statistically stable Delphi consensus perceptions among the panelists. Response distribution exhibited diamond clustering. Seven curriculum statements (20.59%) were perceived to merit inclusion in doctoral programs, 21 curriculum statements (61.76%) were perceived as uncertain inclusions, and six curriculum statements (17.65%) were perceived as excludable.

Comparative analysis of responses of both panels revealed four categories of consensus. Both panels agreed that seven curriculum statements (20.59%) merited inclusion in doctoral programs. Five curriculum statements (14.70%) were perceived by both panels as uncertain for inclusion. One curriculum statement (2.94%) was perceived as excludable by both panels.

Examination of 21 curriculum statements (61.76%) exposed differences in consensus perception between the two panels. The industry panel distinguished 17 curriculum statements in this category (80.95%) as meriting inclusion in doctoral programs and four curriculum statements (19.05%) as uncertain. The education panel perceived 16 curriculum statements in this category (76.19%) as uncertain and five curriculum statements (23.81%) as excludable.

CONCLUSIONS

Leaders in the aviation industry support both the concept and the need for doctoral-level studies in aviation. This finding coincides with results of previous research, which found that aviation educators support the same. Clearly, doctoral programs in aviation would serve the needs of industry leaders and aviation educators. The following conclusions are based on the results of the literature review and survey responses:

1. Industry key informant interview results indicated that elements of a doctoral degree in aviation should reflect the needs of practicing professionals. The 34 curriculum statements generated in the interview process may be classified as:

Twelve statements (35%) -- Business
Four statements (12%) -- Political science
Three statements (9%) -- Education-specific
Two statements (6%) -- Economics
Three statements (9%) -- Aviation-specific
Three statements (9%) -- Legal
Two statements (6%) -- Engineering-oriented
Two statements (6%) -- Transportation
Three statements (9%) -- Various components

This diversity indicates a strong perceived need for an interdisciplinary course of study. Accordingly, this diversity will require great cooperation among college units and schools to provide and permit the cross-collegiate culture required of such a degree program.

2. Both Delphi panels perceived the curriculum statements on international politics, statistical measurement and interpretation, applied research, current issues in aviation, research methods, intermodal transportation, and industry-specific internship as extremely important. The high group mean and low standard deviation demonstrated by both panels on these specific statements may indicate conceptual core components of a doctoral program in aviation. The high group mean and low standard deviation exhibited by the industry panel on the statements of Corporation Law and Accounting Concepts suggest they also could be included in a core component or could stand alone as prerequisites for study in aviation doctoral programs.

The data suggest the following conceptual core component content:

Conceptual Core Components
International Politics
Current Issues in Aviation
Research Methods
Intermodal Transportation
Corporate Law
Advanced Accounting Procedures
Internship
Applied Research

The conceptual core components suggested by data follow traditional academic models for advanced graduate degrees.

3. Curriculum statements ranked by the industry panel as uncertain indicated widely divergent perceptions. This diversity may indicate areas of specialization and represent needs of particular industry sectors.

4. Twenty-one curriculum statements indicated consensus differences between the two panels. At least two conclusions can be inferred. First, the industry panel perceived 81% of these curriculum statements as meriting inclusion, while the educator panel perceived them as uncertain. This perception also may indicate areas of specialization and sector-specific needs.

Second, and more profound, such divergence may indicate information gaps among aviation educators toward the needs and concerns of the practicing profession. Such highly stable differences of opinion, ranging from 5% to 40% differences between mean ratings, may indicate the parties are not in touch with each other's concerns.

5. Aviation educators need doctoral programs for valid internal reasons. Aviation practitioners need doctoral programs for valid external reasons. An industry-supportive doctoral program must focus on evaluation, resolution, and extension of leading-edge industry-specific issues. An education-supportive doctoral program must include the industry issues listed above and incorporate leading-edge educational philosophies, systems, and techniques.

This researcher believes that one solution to this dilemma may lie in the recent history of the aviation engineering community. From 1935 to 1965 most significant advances in aviation education and technology occurred because industry and academia combined to investigate and advance technology. Government played a funding and directional role, but principal academic funding and guidance for many technological advances

DOI: https://doi.org/10.15394/jaaer.1996.1178

occurred when industry contracted academia to investigate and recommend solutions to specific problems

The creation, acceptance, and success of non-engineering doctoral programs in aviation may hinge on establishing similar types of industry and governmental linkages. Aviation practitioners are now confronted with managerial problems of equal or greater dimension and import than the technological problems of the above cited era. Linking and cross-utilizing industry talent and funds could become developmental cornerstones for non-engineering doctoral programs in aviation.

Editor's Note: Reprints of this article are available for $10 each.□

Robert W. Kaps earned a B.S. in Business Administration from Washington University, Master's degrees in Human Resource Development and Legal Studies from Webster University, and a Ph.D. in Workforce Education at Southern Illinois University at Carbondale. He is an Assistant Professor in Aviation Management at SIU at Carbondale.

REFERENCES

Adamski, J. J., & Doyle, T. J. (1993). *Introduction to the aviation regulatory process*. Westland, MI: Hayden McNeil.

American Council on Aerospace Education. (1977). *A survey of collegiate courses in aviation and related fields*. Washington, DC: Civil Aeronautics Association.

Ary, D. (1985). *Survey research*. New York: Holt-Rinehart.

Balaraman, S., & Venkatakrishnan, K. S. (1980, January). Identifying engineering educational goals and priorities for the future: An experiment with the Delphi technique. *Higher Education*, p. 261.

Baty, M. J. (1985). Selection criteria requirements and current qualifications of aviation faculty in higher education (Doctoral dissertation, University of Tennessee). *Dissertation Abstracts International, 46/11-A*, 3259.

Benjamin, A. (1981). *The helping interview*. Boston: Houghton Mifflin.

Berelson, B. (1971). *Content analysis in communication research*. New York: Hafner.

Best, J. W., & Kahn, J. V. (1986). *Research in education* (5th ed.). Englewood Cliffs, NJ: Prentice-Hall.

Bogban, R., & Biklen, S. (1982). *Qualitative research for education: An introduction to theory and methods*. Boston: Allyn and Bacon.

Brooks, K. W. (1979). Delphi technique: Expanding applications. *North Central Association Quarterly, 54*, 377-385.

Campbell, D. T. (1955, January). The informant in qualitative research. *American Journal of Sociology, 11*(2), 339-342.

Cheng, W. L., Elckhoff, J. R., Gedeon, D., & Sinn, J. (1986). Applied technical research: Key to the future for industrial technology [Abstract]. *Conference Proceedings of the 19th Annual Conference of the National Association of Industrial Technology* (pp. 9-13). Normal, IL: Illinois State University.

Clason, D. L., & Dormody, T. J. (1984). Analyzing data measured by individual Likert type items. *Journal of Agricultural Education, 35*, 31-35.

Cooper, J. (1986, February). *Higher education as a field of study: Some future prospects*. Paper presented at the annual meeting of the Association for the Study of Education, St. Louis, MO.

Dajani, J., Sincoff, M., & Talley, W. (1979). Stability and agreement criteria for the termination of Delphi studies. *Technological Forecasting and Social Change, 13*, 83-90.

Dalkey, N. C. (1972). *Studies in the quality of life: Delphi and decision making*. Lexington, MS: D. C. Heath.

Dalkey, N. C., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science, 9*(3), 458-467.

Delbecq, A. L., Van deVen, A. H., & Gustafson, D. H. (1975). *Group techniques for program planning: A guide to* *nominal group and Delphi process*. Glenview, IL: Scott, Foresman.

Department of Transportation, Federal Aviation Administration. (1989). *Transportation in America*. Washington, DC: U.S. Government Printing Office.

Future Aviation Professionals of America, extrapolation from information contained in *Directory of Employees 1989/90*.

Gordon, R. (1969). *Interviewing: Strategies, techniques and tactics*. Homewood, IL: Dorsey.

Gordon, R. (1987). *Interviewing* (4th ed.). Chicago: Dorsey.

Guion, R. M. (1981). Recruiting, selection and interviewing. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (p. 801). Chicago: Rand McNally.

Helmer, O. (1967). *Analysis of the future: The Delphi method*. Santa Monica, CA: Rand Corp.

Hinkle, D. E., Wiersma, W., & Jurs, S. G. (1988). *Applied statistics for the behavioral sciences*. Boston: Houghton Mifflin.

International Air Transport Association. (1993). *Program objects: International aviation degree programme*. IATA Form No. G6091-2/01/93. Montreal: Author.

John, G., & Reve, T. (1982, November). The reliability and validity of key informant data from dyadic relationships in marketing channels. *Journal of Marketing Research, 16*(1), 517-524.

Johnson, J. A. (1993). *The feasibility of developing a professionally accredited non-engineering aeronautical/aerospace science doctoral degree program in U.S. universities*. Unpublished master's thesis, Embry-Riddle Aeronautical University, Daytona Beach, FL.

Johnson, J., & Lehrer, H. (1995). The feasibility of developing a professionally accredited non-engineering aeronautical/aerospace science doctoral degree program in U.S. universities. *Journal of Studies in Technical Careers, 15*(4), 245-255.

Kaufmann, R. A., & English, F. W. (1979). *Needs assessment: Concept and application*. Englewood Cliffs, NJ: Educational Technology Publications.

Leide, G. (1977). Expert judgements as evaluation data. In A. Lewy (Ed.), *Handbook of curriculum evaluation* (p. 306). New York: UNESCO.

Levine, A., & Boyer, E. (1985). *A quest for common learning: The aims of general education*. Washington, DC: Carnegie Foundation for the Advancement of Teaching.

Likert, R. (1932). *A technique for the measurement of attitudes*. New York: Archives of Psychology.

Linstone, H. A., & Turoff, M. (1975). *The Delphi method: Techniques and applications*. Reading, MA: Addison-Wesler.

Lopez, D. (1961). A core for graduate study in industrial arts teacher education. In R. P. Norman & R. C. Bohn (Eds.), *10th yearbook of the American Council on Industrial Arts Teacher Education: Graduate study in industrial arts* (pp. 137-150). Bloomington, IL: McKnight.

Mandis, G. M. (1984). *The aero college aviation directory*. Fallbrook, CA: Aero.

McCracken, G. (1990). *The long interview*. Newbury Park, CA: Sage.

McMillan, J. H., & Schumacher, S. (1989). *Research in education: A conceptual introduction* (2nd ed.). New York: Harper Collins.

Miller, D. C. (1970). *Handbook of research design and social measurement* (2nd ed.). New York: David McKay.

Mueller, J., Schussler, K., & Costner, H. (1977). *Statistical reasoning in sociology* (3rd ed.). New York: Houghton Mifflin.

Naisbitt, J. (1984). *Megatrends* (2nd ed.). New York: Warner.

NewMyer, D. A. (1987). An analysis of the perceptions of aviation educators concerning non-engineering master's degrees in aviation with implications for a first professional degree (Doctoral dissertation, Southern Illinois University). *Dissertation Abstracts International, 49/03-A*, 442.

NewMyer, D. A., & Kaps, R. W. (1995). *Aviation industry employment data estimates revisited*. Manuscript submitted

https://commons.erau.edu/jaaer/vol6/iss3/2
DOI: https://doi.org/10.15394/jaaer.1996.1178

for publication.

Pratt, D. (1980). *Curriculum design and development*. New York: Harcourt Brace.

Reagan, R. (1969, June 16). *Text of Governor Reagan's remarks to the Aerospace-Aviation Management Task Force,* Sacramento, CA.

Rhea, M. J., & Shrock, D. L. (1987, August). Measuring distribution effectiveness with key informant reports. *Logistics and Transportation Review*, *21*(2), 295-306.

Rojewski, J. W., and Meers, G. D. (1991). *Directions for future research in vocational special needs education.* Champaign-Urbana, IL: University of Illinois, Campus Research Board.

Rollo, V. A. (1990). *Aviation programs in the postsecondary schools of the United States*. Unpublished doctoral dissertation, University of Maryland, College Park.

Rosovsky, H. (1990). *The university: An owner's manual.* New York: Norton.

Rowntree, J. S. (1941). *Poverty and progress: A second social survey of York.* London: Longman-Green.

Salancik, J. R., Wenger, W., & Helfer, E. (1971). The construction of Delphi event statements. *Technological Forecasting and Social Changes*, *3*, 65-73.

Strickler, M. K., Jr. (1986). *An introduction to aerospace education*. Chicago: New Horizons.

Taylor, K. (1990). *The marketability of an aviation doctoral degree*. Unpublished manuscript.

Toffler, A. (1980). *The third wave*. New York: William Morrow.

Truitt, L. A. (1995). Labor law and public policy. In R. W. Kaps, *Air transport labor relations* (pp. 9-10). Carbondale, IL: Southern Illinois University Press.

University Aviation Association. (1994a). *Collegiate aviation guide*. Auburn, AL: Author.

University Aviation Association. (1994b). Grant proposal submitted January 19, 1994, to the U.S. Department of Education seeking funding for research into the feasibility of the establishment of a Ph.D. in aviation education. Opelika, AL: Author.

Weaver, M. O. (1988, February). Training 101 from the beginning. *Training and Development Journal*, 18-23.

Wicklein, R. C. (1992, December). *Critical issues and problems in technology education*. Paper presented at the annual meeting of the American Vocational Association, St. Louis, MO.

Wolfe, H. P., & NewMyer, D. A. (1985). *Aviation industry regulation*. Carbondale, IL: Southern Illinois University Press.