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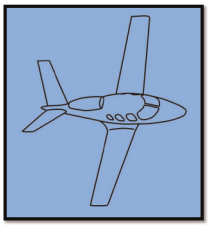

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Assessing Programmatic Design and Quality for a Professional High-Technology Graduate Education Program: A Conceptual Framework

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Abstract

The historical documentation of the development of aviation technology graduate education provides a contextual basis to understand the present need for online post-baccalaureate professional education. Within a case design structure, this article employs the action research framework to assess program design and quality for a newly developed distance-based graduate professional program. The continuous improvement basis deployed herein provides opportunity for immediate program assessment and ongoing quality improvement. The key outcome of this applied case example can be adapted to any professional graduate program as a solution for the maintenance of overall programmatic responsiveness and resulting quality.

Keywords: aviation technology, aviation leadership, ProSTAR, aviation distance learning, aviation professional programs

Introduction

Aviation technology graduate education has evolved as a logical extension to complement and supplement the widespread growth in undergraduate collegiate aviation education in the post-WWII era. Leading this growth were the undergraduate programs emerging from Parks College of Aviation in Cahokia, IL (now part of Saint Louis University; Faherty, 1990), and Embry-Riddle Aeronautical University in Daytona Beach, FL (McCollister & Ramsden, 1986). Subsequent to these developing programs, aviation technology programs, such as that of Purdue University in Indiana, entered this field, bringing the heretofore untapped capabilities of a major state land grant university into the mix. While other aviation education programs did emerge in the post-WWII timeframe as well, these three programs maintained a high profile throughout the undergraduate development period and were well positioned to begin graduate level education. As recently as 1990, no more than eight graduate programs existed in non-engineering aviation. Today, 20 years later, the number of active programs identified is near twelve at the master's degree level and approximately four at the doctoral level (UAA, 2008).

The need for graduate education in aviation is similar to that of other technology fields. Growth in needs coming from both industry and government fuel the demand for higher-level specialists in aviation technology. The higher education community has responded with adequate traditional graduate programs, but has failed to respond in a similar manner with

professional and distance-based graduate programs. Additionally, the growth in undergraduate aviation programs has accelerated demand for faculty with advanced degrees in this academic field. Prior to the (relative) growth of aviation-specific graduate education, aviation professionals who sought advanced education generally turned to programs in related fields. While this has worked over time to supply faculty expertise in collegiate aviation programs, it has had little impact on meeting the growing industry and professional needs for advanced education and training. The spread of post-bachelor's level certificate programs for aviation professionals is one example of this increasing call from industry and government leaders to supply educational opportunities for the full-time aviation professional. In addition, the spread of aviation scholarship and education beyond U.S. and Western European boundaries has created a widely dispersed group of professionals seeking opportunities for advanced training and education (Bowen et al., 2011) yet unable to immediately access those opportunities on a localized basis.

In response to these needs, distance education-based Master's degree and graduate certificate programs to serve working professionals worldwide have begun development and implementation. This study presents a case analysis of one of these programs at a public university in the Midwestern United States.

Distance education and distance learning go by many names, predominately based on the level of face-to-face instruction and whether a student is required to physically attend a brick-and-mortar institution. Distance education takes on names such as online learning, hybrid learning, blended learning, open learning, virtual school, and more. The utilization of a given name is dependent on the environment in which it is used, time and distance, or both. In the end, distance education provides opportunities for advancing one's education which might not otherwise be available. Although it is not necessarily known when the first distance learning opportunity presented itself, it is believed such opportunities began at least as early as 1728 (Holmberg, 2005).

The taxonomy of distance education has gone, from a technology perspective, through a number of increasingly more advanced stages since its beginnings, from paper-based correspondence courses to recent developments using online desktop two-way audio and video web-based delivery coupled with graphics (Morabito, 1999; Mortera-Gutierrez, 2006; Simonson, 2009; Hartman & Springer, 2011). As documented by Hartman and Springer (2011), Kearsley (2007) believes online instruction includes any form of learning or teaching that takes place using a computer network. The evolution of computing technology and the desire for learning in the general populace has given rise to increased usage of online media as an instructional delivery mechanism. People now, more so than any time before, have access to education and learning content due to this delivery medium. Online delivery media allows people the flexibility to control the aspects of their learning experience: learning path, pace, location, time and contingencies of instruction (Lim, 2007).

Current literature suggests that online instruction can be as effective as face-to-face instruction (DETC, 2011; Mackey, 2010). Mackey reports research findings do not suggest cognitive learning is strongly affected by social presence. Critics of online learning environments cite that successful outcomes are too dependent on learner motivation, that online education is unable to engage learners in active learning, and that there is significant development time and cost associated with creating instructional materials and configuring the online learning environment (Daniels, 2000; Englers, 2000; Newby, 2000).

Knowles (1970) suggested characteristics of adult learning nearly 40 years ago; these factors are relevant today as it relates to distance education, particularly with regard to online learning for the purposes of professional practice:

- A supportive environment in which constructive criticism is not aimed at individuals but instead focused on content and ideas.
- The starting point and focus of a course should be the needs and interest of the adult learning.
- Course plans should include clear course descriptions, learning objectives, resources, and time lines for events.
- General to specific patterns of content presentation work best for adult learners.
- Active participation should be encouraged, such as by the work groups, or study teams (Knowles, 2005).

At present, many major colleges and universities across the U.S. are actively engaged in high-end distance education: Georgia Tech, the University of Maryland, the University of Southern California, Purdue University, Penn State University and the University of Wisconsin, to name only a few. Their technological approaches are highly evolved and capitalize on numerous permutations of the distance learning technology spectrum. For example, Purdue has maintained a focus on technology since as early as the late 1870s (Purdue, 2010); "The College of Technology's early roots grew from Purdue disciplines focused on applied learning and engineering principles. . . . Industrial education students today complete coursework within Purdue's College of Technology and College of Education."

Springer, Bertoline, and Schuver (2010), discuss one university's 2009 decision to centralize higher education professional studies into a single, fully-supported academic Center for Professional Studies in Technology and Applied Research (ProSTAR). This program was designed to provide a fee-based distance learning Master of Science degree in Technology, versus the traditional tuition-based

on-campus residential program. Aside from distance-based and on-campus cohort programs, ProSTAR has an active role in promoting an international presence, most recently through activities attendant to global settings. Springer et al. describe these fee-based programs as intended for non-traditional students, primarily those employed full-time while pursuing a degree. Initial programs discussed in Springer et al. were designed using a hybrid distance educational model, one in which students met in a traditional face-to-face classroom setting three weekends each semester. More recently, ProSTAR has been implementing a fully distance asynchronous graduate program in Aviation Leadership (Springer, 2010). However, little has been done in scholarly literature utilizing conceptual analysis to evaluate such an implementation. Part of this is due to the novelty of such a program within the already renowned field of aviation graduate education (UAA, 2008). The authors herein show initial analysis to fill this gap by using a case-based framework to describe and assess the development and quality of the initial phases of the implementation of this asynchronous graduate degree in aviation. It is hoped that dissemination of this analysis will guide other aviation or technology-oriented programs in exploring the benefits, risks and theoretical underpinnings of expanding aviation graduate education.

According to Springer (2010), in the fall of 2010 the ProSTAR center initiated the inaugural offering of the distance learning online Aviation Leadership concentration, leading to a Master of Science in Technology. As discussed and differentiated above, this program is completely distance-based and semi-asynchronous, which means the asynchronous learning modules are sequential, time-phased, and coordinated under the direct and immediate supervision of an instructor. The learning modules are self-paced within the constraints of a given semester syllabus.

The curriculum of this inaugural Aviation Leadership concentration was defined with the collective experiences of academia and industry. Representatives to the curriculum initial discussions were veteran senior employees from three different, yet related, industry sectors: aviation, heavy industry, and the defense industry. The combined industrial experience of this senior defining group was over 150 years. This first program was premised on the concept of helping working professionals transition from positions as technical or non-technical individual contributors to higher-level leadership and management positions within the aviation-specific discipline. Courses in the curriculum were intentionally differentiated from MBA-type courses to provide more appropriate intermediate training. This is not to say those participants to the Aviation Leadership concentration could not academically or intellectually excel in senior-level corporate positions; quite the contrary.

This program, although sufficient for providing aviation leadership and management knowledge and skills to perform in a senior-level corporate capacity, is intended to create the foundational skills of basic aviation leadership and management. Such skills, coupled with an individual's initiative and confidence gained from achieving hierarchically greater levels of responsibility, tend to propel that individual into increasingly responsible senior-level opportunities. It has been recognized in industry that when a technical individual is moved into a supervisory position without proper training in leadership skills and techniques, one both loses a good technical person and gains a less-than-capable manager. The corollary to this scenario is what happens to a leader when he or she is pressured and has not been properly trained in leadership and management skills and techniques. In this scenario, the untrained leader tends to revert to micromanagement of technical subordinates. This occurs because the leader was first and foremost a good technical person themselves, and it was this skill set that allowed them to move into these higher levels of responsibility. Unfortunately, reverting to micromanagement is not ideal at this point in their positions as leaders, since, as such, they are expected to lead and manage. In the situation with a newly appointed technical individual contributor-turned-leader, the one-time good individual technical contributor often does not remain so, as the technology, tools, techniques, practices or methodologies have most likely passed the individual by (Springer, 2010). It is evident, then, that these foundational skills are essential for the successful transition from individual contributor to leader.

The overall program spans contiguous semesters: fall, spring, and summer. Each of the primary semesters, fall and spring, has two courses for a total of six credit hours. The summer semester is two courses for an additional six credit hours. The entire program is 33 credit hours.

The curriculum of the Aviation Leadership concentration was organized around three basic concepts and subsequent sets of courses: leadership, aviation business and technology management, and application of assimilated knowledge. Within the leadership category are courses on leading teams, interpersonal skills, global leadership, human capital management, and organizational development and change. Business and technology management courses are focused on measurement and evaluation, quality management, research methods, project management, and economic decision making. The means of application of the assimilated knowledge is a set of core courses in research methods, research and writing for business and industry, and a culminating capstone project and paper.

The courses that form the core of the curriculum are as follows:

Aviation Leadership - investigates the need for people with leadership ability to better become special assets in all forms of enterprises. Several dimensions of leadership and various approaches to achieving results using new strategies are examined. Current as well as

foundational philosophical literature and research studies in leadership, corporate culture, ethics, and elementary team building are explored.

Multicultural Team Operations - provides a study of the nature and origins of professional, national, and organizational culture and their role in multi-discipline team activities. Studies of international air carriers are utilized and the construct of error management and how it relates within the multicultural environment from the perspective of applied accident/incident case studies are examined.

Operational Assessment and Improvement - develops skills needed to analyze, formulate, and apply pragmatic techniques for work task improvement. Concepts studied include the enhancement of workflow structure, critical sequence element streamlining, and value added analysis development.

Instructional Design for Technology & Industry - examines the practical applications of managing the training process in industry and educational settings, including the development of instructional materials from an adult learner viewpoint. Students design an instructional program using established management training models (H. R. Lehrer, personal communication, 2010).

The specific outcomes expected of the students completing the Aviation Leadership concentration are as follows:

- Develop and deploy appropriate training systems for various aerospace enterprises.
- Select and utilize standard economic and statistical decision-making models in a variety of aviation operational and industrial settings.
- Organize and effectively lead multicultural teams in organizations such as airlines and aeronautical manufacturing companies, as well as in diverse settings such as airports, corporate flight departments, and similar workplaces.
- Assess the state of safety and eliminate human error in aerospace manufacturing, aeronautical operations, and various aviation enterprises.
- Evaluate and effectively manage quality in aircraft production systems such as power plant, airframe, instrumentation, environmental, and flight controls (H. R. Lehrer, personal communication, 2010).

Methodology

As social scientists, educators in both traditional collegiate programs and newly-evolving professional programs should embrace structured scientific inquiry to resolve questions using applications of logical validity and empirical validation (Frankfort-Nachmias & Nachmias, 1996). Numerous tools have emerged that may be applied through accepted principles of scientific inquiry. Most readily acceptable of these have been the tools that provide quantitative data and analytic methods to enhance understanding of such social scientific constructs. However, qualitative research tools, often underutilized in the development of scientifically-based assessment and implementation methods, are rising to a new level of acceptance to bypass the limits of quantitative methodology and address the complex issues facing social science fields today (Bowen, Cartenson, & Boyle, 1999).

Quantitative research remains a very important research paradigm for hypothesis testing and explanatory knowledge, but is limited in its ability to respond to the many rapidly changing variables in this study. Qualitative research, however, is more interpretive in nature and allows for greater analytic depth, but has limitations in its ability for scientifically neutral generalization of findings (Creswell, 1998).

The design of the present study as a qualitatively-based case analysis was selected to provide a structured methodological approach for the purpose of illustration of applicability from the selected research setting to other program examples in related professional graduate areas (Yin, 2003). The case tradition as related by Creswell (1998) illustrates the need to relate rich detail to document the research process and establish the foundations necessary to overall understanding. As discussed by both Yin (2003) and Creswell (1998), the case method allows for the application of multiple tools to examine and relate a well-scoped contextual setting. This approach to descriptive and analytic environmental assessment provides an opportunity to utilize a theoretical framework for academic grounding (Bowen, Cartenson, & Hanson, 1999). For the purposes of the present study, the action research method is used to provide a theoretical framework by which to evaluate and discuss the development and implementation of a distance-based professional graduate education program.

Action Research Framework

Action research as a qualitative framework has been in active use for decades, emerging primarily from groundings in the educational literature (Borg, 1963). While Borg describes the action research framework as facing early criticisms for not adhering to the rigor of traditional scientific methodology, a review of research literature indicates that action research has made significant gains in academic and professional acceptance (e.g., Greenwood & Levin, 1998; Reason & Bradbury, 2001). The advancement of understanding in the social science fields of the limits of quantitative techniques and the growth of systems theory research and models of organizational alignment (e.g., Semler, 1997) to analyze more complex and interdependent issues has likely helped fuel this growth of acceptance.

Action research is often utilized in applied research settings, and while commonly implemented to explore an

educational research issue (e.g., Greenwood & Levin, 1998), the action research paradigm has found widespread implementation in the applied organizational and leadership research literature (e.g., Cummings & Worley, 2005; Lewin & Gold, 1999). Typically, leaders maintain a focus on problems or issue analysis using a number of research strategies within an action research framework. Action research is frequently carried out in a collaborative or team setting, but is also well suited for individual use, as in the teacher-researcher or leader-researcher model (McMillan, 1996).

Using action research as a conceptual model framework does not limit use of other research tools or procedures (e.g., triangulation, survey and observational data gathering) to zero-in on the information needed (Lu et al., 2011). When actively engaged in an administrative process such as program assessment, the evaluation of effectiveness of the process, any return on budgetary investment, and maximization of human resource investment in the process are key points for future research and evaluation that will provide guidance for continuous improvement to the program (Bowen, Cartenson, & Hanson, 1999). Although action research does not portend to have an inherent generalized basis to other settings, use of the action research framework to discuss program development and implementation allows researchers to provide an in-depth example of best practice for those in academia and industry interested in the establishment and growth of advanced professional education programs (Bowen, Cartenson, & Hanson, 1999). As Best (1993) describes it, "action research is focused on immediate application, not on the development of theory or on general application. It has placed its emphasis on a problem here and now in a local setting. Its findings are to be evaluated in terms of local applicability, not universal validity" (p. 24). Approaching the critical issues of evaluation of a novel and innovative educational program (that of distance-based advanced graduate education for working professionals) through an action research model provides a structure to study, evaluate, and initiate change to an ongoing complex problem.

Implementing the Action Research Tool for Program Assessment

An operational definition of action research suitable for the present assessment procedure may be found in Creswell (1998), who describes it as a research method which involves the researchers in the process of acquiring knowledge during an ongoing process in which they are involved. According to Creswell, action research emphasizes the solution of problems rather than the acquisition of scientific knowledge; a focus on real-world application appropriate for the evaluation of the educational program, in which the authors hope others will learn from the analyses and expand such educational offerings. Use of this framework for evaluation of the professional advanced education program thus provides a format that fosters identification, analysis, and resolution of risks, weaknesses, or strategic advantages that may prove either detrimental or beneficial to the program's success. A model of the action research process for program assessment used in the present study and described by Stringer (1996) is summarized in Figure 1.

The application of action research to the continuous development and improvement of aviation graduate education provides the methodological basis for approaching this endeavor. Bowen, Cartenson, and Boyle (1999) previously applied an action research framework to the evaluation of student recruitment and retention programs. Similarly, the present study expands upon such work to apply the framework to evaluating the development and implementation processes and procedures in establishing a distance-based professional graduate education program.

As of this writing, the Aviation Leadership concentration has completed its second semester. Although long-term quantitative assessment has not yet been undertaken due to the relative novelty of the program, the faculty and administration involved in the development and implementation of the program have encouraged and engaged program participants to provide both qualitative verbal feedback and quantitative evaluations of courses which are being used to foster ongoing modifications and enhancements to the program. The collection of these data continues, using the Stringer model as a framework for both the level of data collected and the context of the analysis. In addition, use of the framework has provided invaluable guidance to faculty and administrators in putting the performance and quality of the program into a more readily understandable and modifiable context. Without this framework to guide the program implementation process, the authors firmly believe that engagement of new faculty and administrators in support of the program and the ability of program leaders to make time-critical alterations to facilitate program success would not be possible. To this end, a number of changes have already been made to enhance program success, including:

- Procedural processes on program administration;
- Frequency of student communications for administrative information exchange; and

Look	-Gather relevant information/data
	-Describe the situation
Think	-Explore and analyze
	-Interpret and explain
Act	-Plan
	-Implement
	-Evaluate

Figure 1. The action research process (Stringer, 1996).

	Stringer Model	Assessment Model
Look	-Gather relevant information/data -Describe the situation	10-year longitudinal study
Think	-Explore and analyze -Interpret and explain	Analyze and interpret alternative distance learning and cohort-based methodologies and approaches
Act	-Plan	Twice each semester collect verbal assessment; consider end of semester areas for improvement and continuous
	-Implement -Evaluate	process improvement

Figure 2. Application of Stringer model in program assessment.

- Heightened faculty awareness of participant distance learning concerns.

ProSTAR has recently concluded a ten-year longitudinal study of a cohort-based weekend program in Technology Innovation (Springer, Dyrenfurth, & Schuver, 2011). The findings of this study provided valuable insight into continuous improvement activities, which were incorporated in the Aviation Leadership concentration upon its initiation. The concentration will be included in further studies that are expected to provide additional insight into aviation leadership education and subsequent program offerings. Figure 2 depicts the application of the Action Research Process to the Aviation Leadership concentration.

Discussion

The results of this case, while they are derived from a single-scenario case example, are intended to provide an illustration of program assessment that explains a model of successful graduate professional program deployment in aviation technology through technology-based education. The application of the action research process to frame continuous program development and quality can be extended to many representative programs in similar technology disciplines. The authors' intent is to inspire further works in this vital topical area that will add to the overall body of knowledge and continue the development of assessment modeling and applications thereof.

Through the process described herein, it has been demonstrated that qualitative based research and assessment utilizing the action research framework provides not only a solid foundation for program development and implementation, but also for future program improvement through interpretation of and reflection on the findings of the research and assessment, and through action guided by those findings.

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