3-14-2018

Informing Online Doctoral Course Development Using Student Feedback

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International Journal of Online Graduate Education, Vol. 1, Iss. 1 (2018)

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This paper describes the initial development and continuous improvement of *DAV 715: Human Factors in Aviation*, an online post graduate course in the Ph.D. in Aviation program at Embry-Riddle Aeronautical University (ERAU), from the perspectives of the subject matter expert (SME)/course instructor and the instructional designer/course builder as well as with consideration of student feedback. The process was guided by the 3-Phase Design (3PD) model developed by Sims and Jones (2003). The first section of the paper presents a definition of instructional design and development and salient instructional design challenges. This section also includes descriptions of the Ph.D. in Aviation curriculum, the 3PD model, the adaptation of the 3PD model for use in the Ph.D. in Aviation program, and the DAV 715 course. The next section presents descriptions of the method, including student enrollment data, and the informal and formal data gathering instruments used to collect feedback on the learners' experiences, followed by a discussion of the results and lessons learned. The paper concludes with a summary of the study's findings and implications for future instructional design practices.

Instructional Design and Development

Instructional design (ID) theory is a descriptive and systematic approach for understanding, creating, and improving education and training (Reigeluth, 1983, 1999). It embodies various models and strategies, but the objective is the same—high-quality instruction that addresses an education or training need (Neal & Hampton, 2016; Romiszowski, 1982, 1984). "The desired outcomes of instructional design-, development-, implementation-, and management models are instructional effectiveness, efficiency, and appeal" (Neal & Hampton, 2016, p. 10). Measures of instructional effectiveness typically depend on student achievement scores; measures of efficiency divide instructional effectiveness by the instructional time or by the cost of developing and delivering the instruction; measures of appeal use student satisfaction or motivation to continue with learning (Reigeluth, 1983, p. 20). Instructional effectiveness and appeal are the focus of this study because they inform instructional design decisions, ultimately playing a role in student retention. This last point is most important, because, as the American College Testing (ACT, 2015) reports, the 6-year completion rate for doctoral degrees at private four-year institutions is 55.7%.

Kauffman (2015) reported attrition rates for online courses compared to face-to-face courses vary from minimally higher to 50% higher. Jones (2013) examined 995 research works about issues in doctoral education published from 1971 to 2012. Six themes emerged: doctoral program design (29%), doctoral student experience (26%), student-supervisor relationship (15%), writing and research (14%), employment and career (post-doc) (13%), teaching (3%). Of the 10 issues related to the doctoral program design theme, issues with linkages to practice and industry, quality and scope of training, flexible delivery, and examination and assessment have implications for instructional effectiveness and course design. Of the six issues related to the student experience theme, socialization processes and student support have implications for student satisfaction with learning and course design. Rockinson-Szapkiw, Spaulding, and Spaulding (2016) examined student persistence during the dissertation phase of a doctoral program, and found support services; quality of the program, curriculum, and instruction; academic integration; social integration with faculty; and familial integration were the significant factors contributing to student persistence (p. 108). The theme of quality of academic experiences, including subthemes of program quality, engaging and meaningful learning activities, and the quality of online feedback from faculty and students, was positively associated with student persistence (p. 117).

The challenges in designing any online course include the complexities and limitations of educational technologies, such as the learning management system (LMS) that serves as the delivery platform and the communication and collaboration tools used inside the LMS. Jordan, Kleinsasser, and Roe (2014) argued it is impossible to predict all of the issues students might encounter with online learning technologies and strategies. Some new online students may have little to no experience with online technologies, and much less newly emerging and continuously evolving e-learning technologies, while others might be quite experienced. Motteram and Forrester (2005) examined perceptions of new students in online and traditional face-to-face graduate education programs. A majority of the online students reported being "frustrated by their early encounters with the technology, either because of their own inexperience or the unpredictable local infrastructure" (p. 287). This included difficulties with the LMS. Ivankova and Stick (2007) conducted a meta-analysis on student persistence in a distributed doctoral program. They found 96.2% of the Graduated group had the highest level of comfort with online learning while 47.8% of the Withdrawn/Inactive group were the least comfortable with online learning. Similarly, 68.8% of the Beginning students and 39.1% of the Withdrawn/Inactive students were comfortable with online discussions and the course workload (p. 105).

Distributed learners pose additional challenges in course design. Interactions in an online course can be synchronous, asynchronous, or a blend of both. In an asynchronous course, all essential (required) student-to-instructor and student-to-student interactions and communications are turn-based, meaning there is a time lapse between two-way interactions. Besides being necessary when students live in different time zones around the world, this also helps to avoid disenfranchising students unable to either establish or maintain synchronous Internet connections. Benson and Samarawickrema (2009) found increased instructor-student and student-student separation—transactional distance—required increased course structure and high dialog to meet the learners' needs (p. 11). Recommended strategies included structured tasks to facilitate dialog, and scaffolding discussion complexity and learner support (p. 15). Schmidt and Shaw (2008) reported on the development of an online doctoral course. They found feedback was a major factor in online learning and student satisfaction (p. 74), and they reported students were not satisfied having only one week per lesson, and recommended two weeks per lesson (p. 75).

Another issue that presents instructional design challenges is the frequency that the courses are offered. Content currency, relevancy, and accuracy are more difficult to maintain when courses are either offered or updated infrequently. This can be especially problematic in heavily-regulated and equipment-intense fields such as aviation and aerospace where changes tend to be rapid or common. Consequently, "frequent changes in regulatory policies, modernizations in equipment, and innovations in educational technologies necessitate the use of ID models that emphasize rapid, responsive, versatile, and cost-effective development, delivery, and maintenance of training solutions" (Hampton & Neal, 2018).

The Ph.D. in Aviation program at ERAU began in 2010. The selection process favors highly-accomplished professionals in multidisciplinary aviation and aerospace occupations (S. Hampton personal communication, December 15, 2017). Many of the entrants to the program are new to online learning and they are distributed around the world. A few are currently in military service or are employed by the Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), and similar high-performance organizations.

The curriculum is delivered predominantly online through ERAU's Worldwide online campus; three short residency courses are held at ERAU's Florida campus. The semester-based curriculum is currently comprised of 20 courses. Each is only offered once a year to maintain the instructional workload required of the doctoral faculty; determined by the number of annual admissions, 15-student enrollment limit for each course, and the number of students in the dissertation phase of the program. The degree requires completion of 36 credit hours of coursework—four core courses and eight courses from several multidisciplinary specializations—for the student to be eligible to take the qualifying exam (QE) for doctoral candidacy. Upon passing the QE, the student enters the dissertation phase. If two courses are taken per semester with continuous enrollment, a student can complete the coursework in two years, leaving a maximum of five years to complete the dissertation and graduate.

When the program was created, the target for the student course workload was 15 hours per week. Upon review of the End-of-Course student evaluations, it became apparent to the different SMEs/instructors and the lead instructional designer (co-author) that actual student workloads were higher than the workloads estimated by either the SMEs or the instructional designers when the courses were developed initially. Consequently, many doctoral students worked considerably longer than 15 hours per week in some of the courses. For example, based on personal teaching experience (co-author) and feedback from students, the first design iteration of one of the core courses frequently required 40 hours of student effort per week and considerably more instructor effort. Also during the early years of the program, more students than expected were taking only one course per term instead of two. This meant it was taking them from one to five years longer than expected to enter the dissertation phase; thus, jeopardizing their degree completion within the 7-year limit. This workload issue has remained one of the chief concerns for the Ph.D. in Aviation instructional designer, instructors, and students alike. Nonetheless, the cumulative program attrition rate as of 2016 is only 18% (A. Stolzer, personal communication August 22, 2017).

The 3PD model developed by Sims and Jones (2003) is an iterative and incremental process focused on team-based course development and improvement based on feedback from the students and instructors. As illustrated in Figure 1, Phase 1 of the 3PD model focuses on creating a functional course. "The aim is to design and create a functional online teaching and learning environment that will meet learning outcomes as well as departmental teaching and learning strategies" (Irlbeck et al., 2006, p. 180). Phase 2 focuses on course evaluation "during the learning unit, with feedback from teachers and learners used to modify and enhance the environment" (Irlbeck et al., p. 182). Phase 3 focuses on maintenance or updating the course after it has run. "Following completion of the learning unit, additional modifications and enhancements are prescribed and implemented for subsequent delivery" (Irlbeck et al., p. 182).

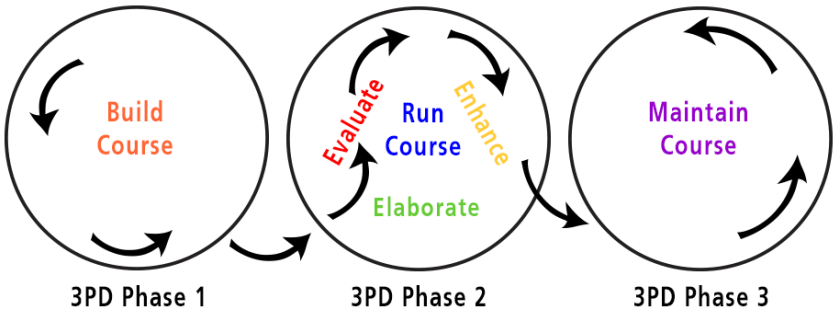

Figure 1. The 3-Phase Design (3PD) model. Adapted from "Developing a Challenging Online Doctoral Course Using Backward and Three-Phase Design Models," by J. G. Neal and S. Hampton, 2016, *Journal of Aviation/Aerospace Education & Research*, *25*, p. 9. Copyright 2016 by the Journal of Aviation/Aerospace Education & Research.

The current instructional development and improvement process for the Ph.D. in Aviation curriculum is best described as an adapted 3PD approach (Neal & Hampton, 2016). As a reflective approach, each iteration of the course allows for improvements both during and after course delivery in response to feedback from the students, instructor, and academic program coordinator (Neal & Hampton, 2016). Because the online Ph.D. in Aviation courses are asynchronous and because of limitations with grades being automatically calculated in the LMS, implementation of the 3PD model is modified as shown in Figure 2. As illustrated in Figures 1 and 2, a course is built during Phase 1. As illustrated in Figure 2, some of the current and emerging needs of the students and instructors are addressed during Phase 2, but within the constraints of the LMS. In Phase 3, the course is updated based on the student and instructor feedback. Evaluation is ongoing during the course (Phase 2) but the student survey data are not analyzed and distributed to the instructor, program coordinator, and academic dean until after the term has ended and the final course grades are officially recorded. Some elaboration occurs during the course but most occurs after the course has run. Enhancement occurs when the course is updated, prior to its next offering to students.

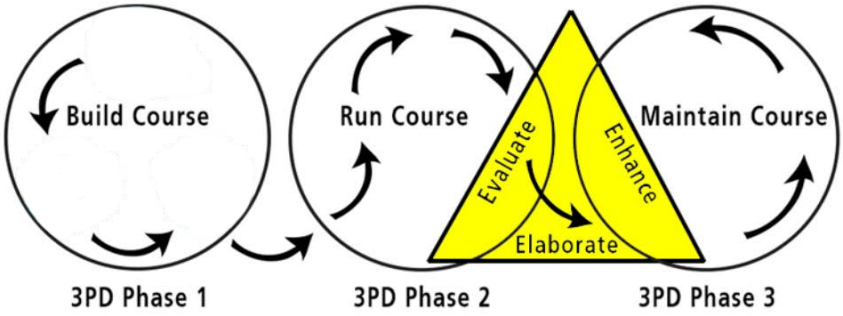

Figure 2. Ph.D. in Aviation instructional development model. Adapted from "Developing a Challenging Online Doctoral Course Using Backward and Three-Phase Design Models," by J. G. Neal and S. Hampton, 2016, *Journal of Aviation/Aerospace Education & Research, 25*, p. 9. Copyright 2016 by the Journal of Aviation/Aerospace Education & Research.

Human Factors in Aviation (DAV 715)

Human Factors in Aviation (DAV 715) is an elective course created in 2012 to support the Aviation Safety and Human Factors specialization within the Ph.D. in Aviation program at ERAU. The course presents "students with fundamental instruction on core human factors concepts and includes practical exercises for demonstrating applications of these concepts within the aviation domain (e.g., cockpit crew, air traffic control, aviation maintenance, spaceflight operations)" (ERAU, 2017, p. 2). Sample activities include a conference-style paper, scholarly critiques, mini-projects, and group discussions. As stated in the syllabus, the student learning outcomes (LOs) are:

1. Describe how pioneers and leaders in aviation human factors have contributed to the theory and/or practice of human factors in this domain.
2. Analyze the factors (e.g., human information processing, situation awareness, mental models, workload and fatigue, human error, etc.) that influence aeronautical decision making and apply this knowledge to identify potential hindrances to successful task performance, at both the individual and team level.
3. Evaluate how the design of advanced aviation technology (e.g., automation, unmanned aircraft systems) can improve aviation safety and performance but can also lead to unforeseen consequences, including changes in operator roles and responsibilities and the nature of their work.
4. Produce original scholarship that demonstrates the application of human factors theories, principles, and practices to investigate and address critical human performance concerns in the aviation domain.

During its initial development, the course underwent heuristic evaluations, pluralistic walkthroughs, and feature and consistency inspections to ensure the activities supported achievement of the targeted learning outcomes while maintaining a reasonable student workload. Nevertheless, feedback from the end users, that is, the students, provide the true measurement of these objectives. The doctoral students are asked to voluntarily complete an anonymous end-of-course evaluation and doctoral faculty complete a different end-of-course evaluation, both based on their experiences with the course implementation. The student surveys solicit reactions to the learning so are considered Kirkpatrick's Level 1 evaluations while the learning assessments administered in the course are considered Kirkpatrick's Level 2 evaluations (Kirkpatrick, 1994). Both types are instrumental in determining the quality and effectiveness of instruction.

Method

From 2013 through 2017, data were collected from students using a learning experience survey they maintained throughout the term and an end-of-course evaluation survey. Responses were kept anonymous to encourage students to provide candid and accurate feedback on the course. The completed surveys were submitted by students at the end of the term. The data generated from the surveys provided insights for updating and improving the course.

Participants

Table 1 presents the total enrollment for each offering of this course from 2013 through 2017. Due to a change in the program curriculum schedule, the course was not offered in 2016. Enrollment ranged from 6 to 14. Also shown are the number of students who submitted a Learning Experience (LExp) survey and an End-of-Course Evaluation (EoCE) survey for each offering. Response rates ranged from 43% to 88% for the LExp and from 71% to 100% for the EoCE.

Table 1
DAV 715 Enrollments and Survey Response Rates

Year, Semester	Enrollments	LExp Responses	EoCE Responses
2013, January	8	7 (88%)	8 (100%)
2013, September	12	— [a]	9 (75%)
2014, September	11	6 (55%)	8 (73%)
2015, September	14	6 (43%)	10 (71%)
2017, January	6	— [a]	5 (83%)

Note. LExp = Learning Experience. EoCE = End-of-Course Evaluation.
[a] Survey was not administered.

Learning Experience (LExp) Survey

Students were asked to evaluate each module (see Table 2) and the course overall (see Table 3). As they completed the activities in each module, students recorded their responses to the LExp survey, a Microsoft® Excel file. A separate spreadsheet was created for each module (e.g., Module 1, Module 2, etc.). The 'Course' spreadsheet at the end of the workbook was used to rate the course overall.

Students were asked to maintain this file throughout the semester. Then, at the end of the course after all course grades had been entered, students were asked to submit their completed LExp survey. The instructor (co-author) provided instructions to the students for how to submit the surveys anonymously.

End-of-Course Evaluation (EoCE) Survey

A standard EoCE is administered by ERAU's Office of Institutional Research. These student surveys become available (open) to students approximately two weeks prior to the end of each course and they close at midnight three days after the last day of the course. All student responses are anonymous and confidential. Compiled data only become available to instructors approximately ten days after the evaluations close and only after all final grades are submitted. The surveys are administered, analyzed, and stored by an independent vendor, and all personally identifiable student information is deleted before the data are compiled into the reports made

available to the course instructors, program coordinators, and college and academic deans (ERAU Office of Institutional Research, n.d.).

Table 2
Learning Experience Survey Items for Module Activities

Category	Item and Response Options
Interest	How interesting did you find this activity? Rate from 1 (Low) to 7 (High). If not applicable, enter N/A.
Relevance	How relevant to the module topic was this activity? Rate from 1 (Low) to 7 (High).
Difficulty	How easy or difficult was this activity to complete? Rate from 1 (Easy) to 7 (Difficult).
Time on Task	How long did it take to complete this activity? Enter in hours.

Note. N/A = not applicable.

Table 3
Learning Experience Survey Items for Course Overall

Category	Item and Response Options
Interest	How interesting did you find this course? Rate from 1 (Low) to 7 (High).
Relevance - DS	How relevant was this course to your doctoral studies? Rate from 1 (Low) to 7 (High).
Relevance - CP	How relevant was this course to your current position? Rate from 1 (Low) to 7 (High).
Relevance - CG	How relevant was this course to your career goals? Rate from 1 (Low) to 7 (High)
Difficulty	How easy or difficult was this course to complete? Rate from 1 (Easy) to 7 (Difficult)

Note. DS = doctoral studies. CP = current position. CG = career goals.

The EoCE items are organized into three categories: Course Experience (k = 8), Delivery Mode (k = 2), and Instructor Experience (k = 7). Space is provided for the students to provide open-ended comments for each category. Only items relevant to the course design (Course Experience) are reported in this study (see Table 4); the item numbers are the actual number sequence in the instrument. Responses to the items (except Item 15) were recorded on a five-point Likert scale, with 5 = *Strongly Agree*, 4 = *Agree*, 3 = *Neutral*, 2 = *Disagree*, and 1 = *Strongly*

Disagree. Response options for Item 15 were: 5 = *More than 15 hours*; 4 = *10-15 hours*; 3 = *Approximately 10 hours*; 2 = *5-10 hours*; 1 = *0-5 hours*.

Table 4
End-of-Course Evaluation Survey Items for Course Experience

Number	Item
12	The learning objectives were clearly stated throughout this course.
13	The grading criteria were explicit and easy to understand.
14	Instructions for course activities and assignments were clear.
15	The average amount of hours I spend working on this course (in and out of class) per week is:
16	The workload in this course was well-distributed throughout the term.
17	This course used a variety of instructional methods, materials, and media.
18	The textbook and/or assigned readings were relevant and supported the learning objectives.

Results and Discussion

No experimental manipulation was administered in this study. In addition, the class size for each offering varied and was too small to conduct inferential statistics to compare means. Thus, only descriptive statistics are reported. Data for each survey are presented separately.

LExp Survey Results

Tables 5 to 7 show the average responses for the LExp survey items on module activities. Table 8 shows the average responses for the course overall.

As shown in Table 5, ratings from the January 2013 course on Interest were consistently favorable across the modules, ranging from 5.45 to 5.89. Ratings on Relevance were similarly favorable across the modules, ranging from 5.58 to 6.06. With regard to Difficulty, students reported finding the module activities moderately difficult, ranging from 2.74 to 3.89. Responses for Time on Task ranged from 12.75 hours to 19.00 hours. Note the highest Difficulty rating and Time on Task were for Module 12, which included the final exam and submission of the final paper.

As shown in Table 6, ratings from the September 2014 course on Interest were consistently favorable across the modules, ranging from 5.81 to 6.65 and were slightly higher than the previous course offering. Ratings on Relevance ratings across the modules were also slightly higher than the previous course offering, ranging from 6.22 to 6.81. With regard to Difficulty, students reported slightly higher ratings compared to the previous course offering, ranging from 3.19 to 4.28. Responses for Time on Task dropped slightly, ranging from 10.09 hours to 15.13 hours. Ratings for Difficulty again was highest for Module 12, which included the final exam and

submission of the final paper. Time on Task was highest for Module 6, which included a critique of a scholarly publication.

Table 5
Average Responses to Learning Experience Survey Items for Modules 1 to 12 (January 2013)

Category	1	2	3	4	5	6	7	8	9	10	11	12
Interest	5.67	5.60	5.67	5.63	5.49	5.45	5.48	5.45	5.89	5.52	5.61	5.69
	1.20	1.13	1.26	1.28	1.50	1.54	1.42	1.63	1.39	1.67	1.57	1.34
Relevance	5.70	5.73	5.92	6.06	5.63	5.78	5.58	5.61	5.91	5.81	5.77	5.91
	1.21	1.06	1.12	1.06	1.12	1.44	1.38	1.39	1.25	1.33	1.37	1.22
Difficulty	2.74	3.34	3.12	3.27	3.21	3.35	3.48	2.78	3.63	2.99	2.75	3.89
	0.44	0.56	0.59	0.53	0.62	0.47	0.59	1.01	0.81	0.59	0.95	0.67
Time on Task	18.53	18.04	17.07	17.22	17.36	17.38	17.46	8.92	15.51	13.14	12.75	19.00
	5.51	4.89	3.17	5.96	4.58	2.52	3.78	2.89	4.67	2.95	5.58	5.79

Note. First row = mean; second row = standard deviation.

Table 6
Average Responses to Learning Experience Survey Items for Modules 1 to 12 (September 2014)

Category	1	2	3	4	5	6	7	8	9	10	11	12
Interest	6.65	6.28	6.30	6.37	6.53	6.57	5.83	6.30	6.10	5.81	6.37	6.27
	0.57	0.81	0.84	0.76	0.59	0.74	1.58	0.86	1.14	1.71	0.91	0.85
Relevance	6.81	6.64	6.67	6.77	6.60	6.77	6.40	6.50	6.37	6.22	6.71	6.58
	0.36	0.45	0.39	0.45	0.44	0.45	0.88	0.56	0.75	1.16	0.33	0.62
Difficulty	3.67	3.75	3.47	3.27	3.50	3.50	3.23	3.43	3.47	3.28	3.19	4.28
	1.20	1.24	1.39	1.61	1.36	1.34	1.63	1.42	1.42	1.61	1.71	0.66
Time on Task	14.26	13.80	10.92	10.09	10.42	15.13	10.27	14.92	11.55	11.72	11.31	14.29
	7.74	4.36	4.73	5.40	5.11	6.22	5.22	1.54	3.99	6.06	6.52	4.14

Note. First row = mean; second row = standard deviation.

As shown in Table 7, ratings from the September 2015 on Interest continued to be consistently favorable across the modules, ranging from 4.72 to 5.85, though slightly lower than the previous course offering. Ratings on Relevance ratings across the modules were also slightly lower than the previous course offering, ranging from 5.08 to 6.10. With regard to Difficulty, students reported slightly lower ratings compared to the previous course offering, ranging from 2.39 to 3.65. Responses for Time on Task dropped slightly for all modules except Module 8 (21.74) and Module 12 (20.57). Values for the other modules ranged from 5.80 to 14.52 hours. Module 12, which included the final exam and submission of the final paper, again had the highest for ratings for Difficulty and second highest for Time on Task. The highest Time on Task was reported for Module 8, which included submission of a draft of their paper.

Table 7
Average Responses to Learning Experience Survey Items for Modules 1 to 12 (September 2015)

Category	1	2	3	4	5	6	7	8	9	10	11	12
Interest	5.53	5.50	5.32	5.20	5.48	5.48	5.52	5.72	5.76	5.00	4.72	5.85
	1.31	1.61	1.72	1.44	1.93	1.59	1.68	1.08	0.89	1.50	1.68	1.08
Relevance	5.86	5.70	5.40	5.28	5.64	5.56	5.56	5.80	5.80	5.08	5.28	6.10
	0.78	1.11	1.38	1.21	1.74	1.49	1.66	0.98	0.91	1.51	1.16	0.88
Difficulty	2.39	2.67	2.68	2.60	2.60	2.96	2.64	3.04	3.04	2.53	2.84	3.65
	1.00	1.12	1.23	1.36	1.48	1.49	1.62	1.47	1.07	0.61	0.78	1.15
Time on Task	10.23	8.88	7.87	6.57	6.60	11.62	5.80	21.74	14.52	9.40	6.83	20.57
	4.95	3.59	4.07	2.87	2.87	2.67	3.39	10.58	3.64	4.18	4.30	8.90

Note. First row = mean; second row = standard deviation.

Table 8
Average Responses to Learning Experience Survey Items for Course Overall

Category	January 2013	September 2014	September 2015
Interest	6.33 (1.15)	7.00 (0.00)	6.50 (0.58)
Relevance - DS	6.25 (0.96)	7.00 (0.00)	6.25 (1.50)
Relevance - CP	4.50 (0.58)	7.00 (0.00)	5.00 (2.55)
Relevance - CG	5.50 (1.00)	7.00 (0.00)	6.20 (1.30)
Difficulty	4.50 (0.58)	4.75 (0.50)	4.60 (1.14)

Note. DS = doctoral studies. CP = current position. CG = career goals. Value represents mean with standard deviation presented in parentheses.

As shown in Table 8, students consistently reported finding the course interesting, ranging from 6.33 to 7.00 for the 2013, 2014, and 2015 courses. Students also consistently reported finding the course relevant to their doctoral studies, ranging from 6.25 to 7.00. Student ratings for relevance to their current position were also favorable, though slightly lower than the previous two items; ratings ranged from 4.50 to 7.00. Ratings for relevance to the students' career goals were also favorable, ranging from 5.50 to 7.00. Although students in the September 2014 gave the highest possible ratings on these items, it cannot be determined if these high ratings were due to changes in the design of the course for that offering. Finally, student ratings on course difficulty were consistent across course offerings, ranging from 4.50 to 4.75.

EoCE Survey Results

Table 9 shows the response data for the seven items of interest from the EoCE survey across the five offerings of the course.

Table 9
Average Responses for Course Experience Items in End-of-Course Evaluation

Item	January 2013	September 2013	September 2014	September 2015	January 2017
12	4.75 (0.46)	4.78 (0.44)	4.88 (0.35)	4.90 (0.32)	4.25 (0.96)
13	4.88 (0.35)	4.89 (0.33)	4.88 (0.35)	4.90 (0.32)	4.60 (0.55)
14	4.75 (0.46)	4.78 (0.67)	4.88 (0.35)	4.90 (0.32)	4.60 (0.55)
15	4.50 (0.76)	4.56 (0.53)	4.38 (0.52)	3.80 (0.92)	3.60 (0.89)
16	4.63 (0.52)	4.33 (0.50)	4.38 (0.52)	4.50 (0.53)	4.20 (0.84)
17	4.75 (0.71)	4.78 (0.44)	4.75 (0.46)	4.60 (0.52)	4.40 (0.89)
18	4.88 (0.35)	4.89 (0.33)	4.88 (0.35)	4.80 (0.42)	4.80 (0.45)

Note. Value represents mean with standard deviation presented in parentheses.

Average ratings for all items, except item 15, were consistently between 4 (*Agree*) and 5 (*Strongly Agree*), indicating a favorable evaluation from students across the five offerings of the course. Average ratings for item 15, which assessed the average amount of hours spent working on this course per week, showed an incremental albeit small decrease across the five course offerings. Average ratings were between 4 (*10-15 hours*) and 5 (*more than 15 hours*) during the first three iterations, dropping to between 3 (*approximately 10 hours*) and 4 (*10-15 hours*) for the last two iterations.

Qualitative student feedback was valuable to identify what worked well and areas for improvement, particularly with regard to workload. The following examples summarize the various open-ended comments provided by students on the EoCE survey.

- One week modules are very challenging for many students, including myself… modules should be spread over a minimum of two weeks, preferably three.
- I would suggest a different format for the discussions: a pair of students prepares detailed presentations for the module's discussion topic. For example, one student could summarize key points from the readings, while the second could prepare a case study based on the readings. These students are graded. The remaining students engage in a town-hall with the first students to amplify their work and explore different aspects of the topic. These students are not graded, subject to the normal assessment of decorum, etc. A different pair of students would lead each module. This approach has many benefits, including a degree of predictability for the students "at bat" and some flexibility for the others.
- There should only be one written assignment per week. I typically spend upwards of 15 hours on these, and I am not alone in this.
- I definitely prefer two-week modules over the single-week module classes. Two-week modules give the student "some room to maneuver" and enough flex to travel and maintain an aggressive professional schedule, and still get quality class assignments completed.
- Some weeks tended to take more time than others for assignment completion. If any recommendation could be made regarding workload, it might be to change the balance

of writing assignment goals and discussion board goals when both are required in a given week. For example, when a discussion board topic is introduced, offer a less intensive writing assignment and place greater emphasis on discussion board interaction.

- The workload would sometimes be up and down, but in some ways that was a relief. It gave us some tough weeks but also some easy weeks to get caught up with our other course, so it turned out to be a nice mix.
- A comment on the workload. . . this is one of the only classes I've had where the workload is actually evenly distributed. It made for better learning/retention and an overall more pleasant experience.

Student Achievement

Across the five offerings of DAV 715, one student withdrew due to medical issues (September 2013), one student failed the course due to lack of participation (September 2013), and one student earned a B (September 2014); all other students earned an A in the course. The first three offerings were presented using the Blackboard® Learn LMS and the more recent two offerings were presented using the Canvas® by Instructure LMS. The means (with standard deviations in parenthesis) for these last two offerings were 97.49 (1.14) for September 2015 (N = 14) and 97.62 (0.82) for January 2017 (N = 6).

Lessons Learned

As noted earlier, no experimental manipulation was administered in this study. In addition, the class size for each offering varied and was too small for statistical comparison. The assumption was that the students would answer honestly and correctly; however, the varied response rates for the surveys limited the insights gleaned from the results. Nonetheless, responses from the students who did submit surveys were consistent and their feedback guided the course redesign.

An important lesson learned from the January 2013 offering was the importance of carefully structuring the course assignments to help students manage their workload. Notable changes to the course after this term included replacing the research paper, which had no page limit, with a five-page conference-style paper using a template modeled after an actual conference paper submission template. The number of discussions (10 to 6), critiques (5 to 4), and projects (5 to 4) were reduced. These deleted activities (discussion questions, critiques, and projects) were revised, as appropriate, and used to create a test bank of essay questions for the final exam. The fixed time limit for the final exam was removed, allowing students to work on this assignment throughout Module 12.

Student workload continued to be a concern in the next course offering. Thus, additional changes were made to the course following the September 2013 offering. Module activities were revised to make student workload more manageable. These included further reducing the number of discussions (6 to 4), projects (4 to 3), and critiques (4 to 2); revising the critique activity to make it less prescriptive; and revising the course schedule to spread out due dates for major deliverables for the projects and critiques.

As indicated in the EoCE results for the September 2014 course, workload continued to be a concern; five out of eight students reported spending 10-15 hours each week and three students reported spending more than 15 hours to complete the assignments. Thus, further reductions were made to reduce the workload and redistribute grading weights. The number of projects was reduced (3 to 2), with the deleted activity added to the final exam test bank. The grading of the class discussions was changed from a numerical score (0 to 100) to complete/incomplete. Notably, this change in scoring did not reduce the quality of the students' contributions to the discussions.

The EoCE results for the September 2015 and January 2017 offerings were encouraging, indicating a reduction in the workload reported by students. Following the September 2015 offering, three of the four discussion activities were changed from instructor-led to team-led discussions, each spanning three weeks. The goal of this design change was to increase student engagement and distribute the workload of these activities.

Following the January 2017 offering, additional changes to the course were implemented. Although students responded favorably to the course textbook, the book was published in 2010 and some of the content was somewhat dated. Thus, a recently published book on Human Factors was selected for the January 2018 offering. The structure of this new book also permitted making significant changes to the course schedule, while still supporting achievement of the course learning outcomes. Specifically, the coursework was broken into five learning modules, all but one spanning multiple term weeks. Module 1 is one week, Modules 2 to 4 are three weeks each, and Module 5 is two weeks long. In addition, students now have two weeks to complete their final paper and final exam. The multiple week schedule distributes student workload throughout the course. Student feedback will be solicited, as with previous offerings, to evaluate how these changes affected students' learning experience in the course.

Summary and Conclusion

The goal of instructional design is to produce quality instruction that addresses an education or training need (Romiszowski, 1982, 1984). The desired outcomes of instructional models include instructional effectiveness, efficiency, and appeal (Reigeluth, 1983, 1999). Effectiveness relies on measures of student achievement and appeal relies on measures of student satisfaction (Reigeluth, 1983).

This study provides insights from the dual perspectives of the SME/instructor and course designer/builder into how the appeal of one of the courses in the Ph.D. in Aviation program was improved using an adapted 3PD model while maintaining learning effectiveness and reducing student workload. These findings are consistent with what Neal and Hampton (2016) reported about adapting the 3PD model for a course in this program. Soliciting and incorporating feedback from doctoral students is essential to producing relevant instruction that enables students to achieve their immediate and long-term educational goals.

Initially, the doctoral courses were designed to require about 15 hours of student coursework per week. However, students were working considerably longer, prompting many to take only one course per term as opposed to two as expected. After multiple design iterations of this course and the other doctoral courses in the program, it was determined that the target

workload needs to be 8 to 10 hours per week. The original Ph.D. in Aviation coordinator, explains it with this analogy: “The goal is for the students to sweat hard, not long” (A. Stolzer, personal communication, August 22, 2017). High academic rigor does not have to equate to high workload. Indeed, the results of this study show that academic achievement (learning effectiveness) did not suffer from reducing the student workload and making the course more appealing to the students.

This study also shows that relying on user feedback (Schmidt & Shaw, 2008) and adapting the 3PD model within the constraints of the LMS can be a successful approach to the instructional design and continuous improvement of online doctoral courses (Neal & Hampton, 2016). Creating new courses with the intention of letting them *sit on the shelf* for a few years before updating them may provide the best return on investment for a university in terms of cost. However, it is not best for doctoral students if they are unable to complete their degree within the time limit because the course design is not responsive to their needs (Irlbeck et al., 2006; Sims & Jones, 2003).

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