Human factors for the undergraduate aviation student

by

Jami Marie Higdon

B.S., Indiana State University, 2013
M.S., Indiana State University, 2015

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF EDUCATION

Department of Curriculum and Instruction
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2024

Abstract

Many things can influence a student's success in a course. Previous research has shown that students are more successful when they complete the course reading, but students may not always comply with reading requirements for multiple reasons, such as other time pressures or financial costs. Issues with reading requirements may be compounded if an instructor has to re-organize a textbook or supplement a textbook with other materials which may result in confusing reading assignments or extra reading. Students also perform better in well designed courses; however, teachers do not always have the resources to fully design a course before implementation. This may be especially true if a teacher is assigned a course outside of their core subject matter expertise. This curriculum product addresses the design concerns by providing a prescriptive constructive curriculum to teach Human Factors for Undergraduate Aviation Students. The prescriptive aspect of the curriculum is meant to support the instructor, not meant to infringe on academic freedom. Assignments and reading expectations are aligned with industry objectives and designed in accordance with key literature for well designed courses that encourage learning beyond rote memorization.

Key words: Aviation Human Factors, Crew Resource Management, Constructivism

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Approved by:

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Dr. J. Spencer Clark

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Dedication

I dedicate this to those that have suffered through this project with me; Sabra, Francine, Betsy Lee, and Rhys.

Chapter 1 Introduction

The opinions on textbooks - why one is chosen, and another not, what formatting, design, or layout is better, glossary or not, and what type of pedagogical aids are present - are as varied as the methods of utilizing them. Textbook development is also influenced by several factors, including the author's motivations and publisher requirements. Sometimes, these influences do not provide an adequate product for other educators to adapt to their needs. Other times, the personal needs of the students can impact the decision to adopt a textbook. All these factors can also lead an educator to develop a new textbook instead of adopting a commercially available one.

Background of the Problem

To understand how to design a new textbook, it is essential to understand the purpose of textbooks and their relationship with student learning. Textbooks can be found in classrooms nationwide at every level of education, from kindergarten to doctorate programs. Textbooks are beneficial for providing structure and organization (Benhur Oral, 2013; Khutorskoi, 2006; Lee & Catling, 2016) and provide “the linkage between lectures, assignments, and examinations” (Berry et al., 2011, p. 31). The problems I have encountered with Aviation Human Factors textbooks are the same as those with other subjects’ textbooks. These issues include how much students use them, how much they aid in learning, are they worth the financial cost, and do they contain the necessary information.

Student Compliance with Course Readings

Unfortunately, textbook adoption for a course does not automatically lead to student compliance with readings. Even though many educators expect students to complete course

readings to be successful, Berry et al. (2011) found that most students did not read at all (17.80%) or read less than an hour a week (42.80%). In the French et al. (2015) study, most students (46%) reported they learned more from the class sessions, and only 36% indicated that the textbook was their primary source of learning (p. 173-174). The 2018 Babson Report found that only 57% of faculty teaching introductory courses reported that 90% of their students had access to all required textbook(s) (Seaman & Seaman, 2018, p. 18).

So, this leaves a few questions: 1) Is it important for students to do the reading, 2) Why do students not complete course readings, and 3) How do we increase student readings? First, let us start with why students should do the readings.

Importance of Reading. A study of science students by French et al. (2015) found that students who reported reading "often" did statistically better in the class than students who reported reading "sometimes". In an odd twist, students who reported reading "rarely" did statistically better than students who reported reading "sometimes" and "often." However, when the data is organized by the instructors' requirements for the course, a curious distinction develops. In the classes where some test questions were solely from the textbook, students who "often" completed the reading performed statistically better than students who "sometimes" did the reading. Even though students who read "often" had a higher average score than students who "rarely" read, the relationship was not statistically significant. Only in classes where test and quiz questions did not include questions solely from the textbook did students who "rarely" did the reading do better than those who "often" completed the reading. Wyss et al. (2013) studied biology students and found that reading compliance did not have a statistically

significant impact on course performance. Unfortunately, this study did not include any information regarding the course requirements.

Why Students Do Not Read. Sikorski et al. (2002) found that almost 80% of students reported not reading or reading sparingly for at least one introductory course. Some teachers provide lecture notes covering all the required information, making reading the required text unnecessary (French et al., 2015). If the students do not need to read the text to be successful, there is not much incentive to obtain a copy of the book.

Other reasons students do not read include being unprepared for the reading comprehension requirements, low motivation, not enough time (other responsibilities), or students underestimate the importance of reading (Leamson, 1999, as cited in Kerr & Frese, 2017; Lei et al., 2010). Students may also choose to refrain from purchasing course materials if they are cost prohibitive. According to the Bureau of Labor Statistics (BLS; 2016; 2021), textbook costs increased 63% from 2006 to 2016, continued to increase until May 2018, then decreased intermittently, making for a rise of 32% from 2011 to 2019. Other educational costs are also increasing, making textbook costs just one more financial worry for students (BLS, 2021). In the Babson Report, 52% of faculty said that students did not have the textbook because of the cost (Seaman & Seaman, 2018). Most department leaders and faculty agree in varying degrees that the cost of course materials is a serious problem for students.

Faculty can choose textbooks with costs in mind by choosing resources available in the institution's library (Pitt et al., 2020, p. 309). In the Pitt et al. (2020) study because the majority of faculty chose books available in the school library, 52.8% had zero expectation that students

would purchase the course materials, 25% thought students would buy one book and 22.2% thought students would purchase more than two.

Faculty can also decrease textbook costs by choosing Open Educational Resources (OER; Petrides et al., 2011, p. 43). OER "are learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, reuse, repurpose, adaptation and redistribution by others" (United Nations Educational Scientific and Cultural Organization [UNESCO], n.d., para. 1). These materials are available electronically for free and some can be purchased in print. Since OERs can be updated quickly and adapted to individual course needs they provide educators with more flexibility than traditional print books.

Increasing Student Reading. According to Landrum et al. (2012), "[s]tudents *use* textbooks when study aids and chapter reviews are provided, when an instructor uses a textbook, and when the book is easy to use" (p. 20). Teachers have multiple techniques to encourage students to complete course readings. These techniques include reading quizzes (Carney et al., 2008; Conner-Greene, 2000; French et al., 2015; Sappington, Kinsey, and Munsayac, 2002); and learning logs (Carney et al., 2008). Nevertheless, the key to these techniques is that the instructor uses the textbook but does not recreate the reading in lectures or lecture notes.

Pedagogical aids, such as review questions, key terms, glossaries, outlines, and others can provide structure to encourage students to use the text. In a review of Psychology textbooks, Marek (1999) found the most common pedagogical aids were "boldface and italic type, chapter outlines, and chapter summaries" (p. 12). Studies have found that the most helpful aids or the ones students are most likely to use are boldfaced terms (Weiten, 1996;1999; Gurung, 2003;

Marek et al., 1999), running or chapter glossaries (Marek et al., 1999; Weiten, 1996;1999), chapter summaries, self-tests (Weiten, 1999;1999), italicized terms, and practice questions (Gurung, 2003). Gurung (1992) found that 92% of students identified boldfaced terms as moderately or extremely helpful (p. 93).

The pedagogical aids students are least likely to use are chapter outlines, discussion questions, chapter learning objectives (Marek et al., 1999, p. 15; Weiten et al., 1999, p. 106), and pronunciation guides (Weiten et al., 1999, p. 106).

Student perceived helpfulness and usage of aids can depend on their gender or academic ability. Gurung (2004) reports that over the course of their study, women's use of pedagogical aids decreased while men's increased. Women consistently reported using bold terms more than men did. Gurung (2004) determined that there was an inverse relationship between student ability (as measured by ACT scores and high school grade point average [GPA]) and the use of pedagogical aids, whereby students with a greater ability utilized pedagogical aids less than lower ability students. Weiten (1999) found the opposite to be true, using the previous semester's GPA to measure student ability. Unfortunately, Gurung (2003; 2004) reports that using pedagogical aids and improved student performance is not statistically significant. In fact, "the perceived helpfulness of key terms was negatively correlated with exam scores" (Gurung, 2004, p. 165). Therefore, if pedagogical aids are "designed well," and students utilize them to test their understanding and, therefore, vary their study habits to improve learning, then pedagogical aids can improve student performance (Gurung, 2004, p. 166).

Student reading compliance can be linked to student success in a course, however if factors prevent students from completing the readings (i.e., textbook costs, no motivation, lecture

notes are sufficient to study) the instructor may have to explore alternatives to increase student compliance of readings. However, the lack of students completing readings may be compounded by the fact that to meet course content requirements and objectives, some texts must be supplemented by other materials which may lead to an excessive amount of reading for students, with some unnecessary material being covered. In the 2018 Babson Report 68% of teachers reported they skipped sections in the textbook, 70% of faculty reported they taught topics in a different order, 45% said they replaced content with their own material and 41% replaced content with material from other sources (Seaman & Seaman, 2018, p. 28). Depending on the copyright of the OER, it can be significantly easier for educators to adjust to meet their needs than commercially available texts.

Statement of the Research Problem

Textbooks are prevalent throughout education, however their use by students can be positively or negatively impacted by the teachers' requirements and course design. Student compliance with readings and therefore course success, can be increased through various course activities as discussed earlier. Utilizing OERs can mitigate many of the issues associated with textbooks since they are free (or low cost for print versions) and often adaptable. However, currently there are not any OER textbooks available for Aviation Human Factors.

The content knowledge identified for this course, which forms a portion of the theoretical framework, is a combination of the KSU Course Catalog Description, the Federal Aviation Administration's Crew Resource Management Advisory Circular, and industry objectives and outcomes. Due to the unique needs of the KSU Aviation Human Factors course multiple instructors have had to supplement the course reading material from different sources. Access to

the current book adopted in the KSU Aviation Human Factors course is not a significant issue since it is one of two books available for unlimited electronic access and download through the KSU library. But this still does not address the issues of content coverage and student usage.

Purpose of the Study

This research had two purposes. First conduct a content analysis to identify how well the current human factors books on the market met the needs of K-State Salina (KSUS). With the results from the content analysis and a literature review which explored several aspects associated with textbook usage, content, and design that can impact student learning, I sought to develop a curriculum product in the form of a textbook that met my individual needs and the needs of my students and could be adapted by other teachers.

This research will guide the development of a textbook for the KSU Aviation Human Factors course. This text will be at no cost for the students, include the necessary knowledge areas, and appropriate pedagogical aids. Whereas the textbook will not be able to force teachers to include test questions that are only from the textbook and not included on lecture notes, questions will be included for instructor use that supports this method of encouraging students to complete the reading.

Research Questions

Before completing a new textbook, this research required a content analysis of texts already commercially available. This content analysis was conducted with two research questions in mind.

Research Question 1: Which of the necessary topics do the commercially available aviation human factors books include and exclude?

Research Question 2: What pedagogical aids were present in the commercially available aviation human factors books?

Methodology

The coding framework was created by reviewing the course catalog description, educational objectives, and guidance by the Federal Aviation Administration Advisory Circular regarding Crew Resource Management Training. Each chapter of the chosen texts was analyzed using the coding framework to identify the dimensions and subcategories covered and the depth of coverage.

Statement of the Significance of the Study

Significance to Kansas State University Students

This project will be designed specifically with the KSUS Aviation Department's needs in mind and will incorporate all the program requirements, thus minimizing the need to supplement the material to meet objectives. The electronic format and the fact the text is being written specifically for my course will make the cost negligible for students. The only cost will be if the student chooses to print the book to have a hard copy.

Significance to Other Educators

The development process required the creation of a coding framework to evaluate the content and design of other textbooks to identify key concepts and ideas. The design of the coding framework provides a methodology other teachers can use to assess textbooks in their own subjects. The textbook will provide a product based on pedagogical and content research.

Students perform better in well-organized courses (Roksa et al., 2016). Most teachers have experienced the misfortune of designing while they were implementing a new curriculum.

The organization of curriculum that is implemented as it is developed is often poor and with a lot of "well that did not work the way I planned." This curriculum product will minimize the frustration for both educators and students by providing a springboard to start with. The organization is designed to motivate students to participate in learning activities which includes scaffolding activities to help students build the knowledge to be successful. The curriculum's learning objectives will ensure that students and teachers know what the students are expected to learn. Scaffolding assignments, class discussions, and grading rubrics will provide details on how they will be expected to demonstrate that learning.

Ethical Considerations

The research started from the belief that commercially available texts do not address all the requirements for all courses. Therefore, the analysis could ultimately be skewed to find the missing topics as opposed to celebrating the topics that were included in each text. The following methods of ensuring reliability and validity will limit the influence of this bias on the research.

Reliability

In content analysis reliability measures how the consistency of the analysis results (Schreier, 2012, p. 167). Content analysis requires a coding framework to be replicable and can be agreed upon by other experts (Krippendorf, 2019, p. 280). For this reason, it is important to have coding instructions with a clear description of the coding frame and units being analyzed. Krippendorf (2019) emphasizes that the instructions should be updated as the analysis continues, but that discussing any issues with other coders should be avoided (p. 284).

According to Krippendorf (2019) there are three types of reliability: stability, replicability, and accuracy or surrogacy. Accuracy and surrogacy require established standards

that can be compared to the coding results (Krippendorf, 2019, p. 282). This is the strongest method of ensuring reliability, unfortunately standards do not exist to compare the results of this study to, therefore reliability will be demonstrated through stability and replicability.

Stability refers to how the analysis changes and answers the question if the research is measuring the same thing at the start of the analysis as they are at the end of the analysis. Stability can be achieved by using the test-retest method (Krippendorf, 2019, p. 282) or also called comparisons across points in time (Schreier, 2012, p. 167), where one researcher goes back over previously analyzed material. To achieve stability, I conducted three reviews of the material and reviewed previous material each time I had to update or adjust the framework.

If someone else can utilize the coding framework to analyze material and find the same or similar results, then the framework is replicable (Krippendorf, 2019, p. 281). This is also referred to as comparisons across persons (Schreier, 2012, p. 167). Yiting Chu (2017) completed a content analysis of 29 reviews of social studies textbooks. Chu (2017) stated that none of the studies established validity of their codes by consulting a panel of experts. Replicability was achieved by having a colleague review multiple chapters and analyzing them using the coding framework. To avoid biasing the analysis by discussing any issues my colleague may experience, I requested they keep notes on any decisions they made that were not already addressed in the coding instructions.

Validity

There are several ways to define and demonstrate validity. Face, content, construct, and criterion validity are all common methods of validity (Krippendorf, 2019, pp. 361-363; Schreier 2012, pp. 185-186). Schreier (2012) states face validity is more appropriate for content analysis

utilizing inductive reasoning and defines it as "*[f]ace validity* refers to the extent to which your instrument gives the impression of measuring what it is supposed to measure" (p. 185). Face validity is also seen as how much it "makes sense" (Krippendorf, 2019, p. 361). The face validity of this research is supported by the describing the method of synthesizing the Aviation Accreditation Board International (AABI), International Standards for Technology Education (ISTE), and National Association of Colleges and Employers (NACE) objectives, the analysis of the KSUS Aviation Human Factors Course Catalog Description, and the Federal Aviation Administration's (2004) CRM Advisory Circular to develop the coding categories. A full description of this process can be found in Chapter Three. See also Appendix B.

According to Krippendorf (2019) establishing validity for content analysis requires a shift from traditional types of validity for psychological tests (such as construct validity and content validity) but instead requires looking at three things; 1) "[e]vidence that justifies the treatment of text, what it is, what it means, and what it represents" (p. 365), 2) "[e]vidence that justifies the abductive inferences that a content analysis is making" (p. 366), and 3) [e]vidence that justifies the results, whether a content analysis contributes answers to the research questions of other researchers or is borne out in fact" (p. 366). Evidence to justify the results of this study are not currently available, therefore correlational validity is not yet possible (Krippendorf, 2019, p. 378). But predictive validity may still be a possibility in the future (Krippendorf, 2019, p. 381). The validity for this study will rely on justifying the treatment of the text through sampling and semantic validity and justifying the inferences made through structural and functional validity.

Sampling and semantic validity both refer to aspects of the materials chosen for the analysis. Sampling validity refers to validating the choices in what sources were included in the

analysis (Krippendorf, 2019, p. 366). This research does not attempt to include all aviation human factors books on the market. To do so would be time and cost prohibitive. Why some books were included, and some were excluded is discussed in "Delimitations" below and Appendix D. Semantic validity requires the coding framework to maintain the context of the materials analyzed (Krippendorf, 2019, p. 366). To maintain the true meaning of the texts but to allow for variations in the terms used, a list of synonyms, explanations, and the decision rules have been provided for each topic in the coding frame. This list does not include every synonym possible since that could move the analysis away from the original intention of the material. The full description of the codes is included in the coding framework in Appendix C.

Structural validity and functional validity justify the abductive inferences made (Krippendorf, 2019, p. 367). Structural validity requires establishing clearly how the coding framework was developed and how the individual codes contributed to the aggregate analysis of each text. In this way, it is similar to face validity and will be established in the same way. Functional validity requires the construct to work (Krippendorf, 2019, p. 377). This research will rely on the test-test and test-retest methods used for establishing reliability and to also establish functional validity.

Delimitations

This research was specifically limited to Aviation Human Factors concepts; therefore, the findings are not generalizable to other topics, but the process followed regarding the development of the coding framework and method of source evaluation can be applied to other educational subjects.

The textbooks analyzed in the content analysis are not in any way all of the human factors books on the market, but they fit a limited criteria regarding focus and content. The exclusion or inclusion of other books in the analysis may adjust the content analysis findings. See Appendix D for a description of why books were excluded.

Limitations

External factors had a significant impact on the definition of the dimensions within the coding frame. AABI, ISTE, and NACE objectives, FAA CRM curriculum topics, and the KSUS Course Catalog description were used to establish and define the coding categories. Unfortunately, since the KSUS Aviation Department does not define specific behaviors that support each learning outcome or objective the specific information necessary to meet the topics in the course description is fairly broad.

Definition of Terms

Aviation human factors and education both utilize very specific concepts and topics. The following terms will be used.

- Aviation Human Factors – multidisciplinary science that focuses on "optimizing human performance and reducing human error" (FAA, 2004, p. 2).
- Crew Resource Management – "the effective use of all available resources: human resources, hardware, and information" (Federal Aviation Administration, 2004, p. 2).
- Constructivism – educational approach with multiple interpretations that emphasizes the development of reasoning and judgment by stimulating students' intrinsic motivation and utilizing authentic assessment to evaluate learning. See Chapter Two for sources utilized to develop this definition.

Researcher Positionality

There are several factors that influence the final textbook product. Authors must weigh their personal attitudes and motivations along with student needs, in addition to curricular requirements and publisher requirements. Understanding those influences are important for determining if the text is appropriate for course adoption.

Personal Motivations

It is imperative to understand the motivations and intentions for this project before it can be implemented. During my time as an educator, I have struggled to find who I am. I have often run into issues implementing a new curriculum and designing a student-centered curriculum because I was tasked with creating the material as I taught the course, and I was overwhelmed with the contradictions surrounding student-centered, inquiry-based courses. Now that I have had the opportunity to research constructivism, the design of objectives and learning experiences, and implement and evaluate, I feel many educators can benefit from this steppingstone to identifying who they are and implementing student-centered activities.

Some authors (including myself) are motivated to provide a textbook for teachers who may not be specialists (Lee & Catling, 2016). Eisner (1991) warns against teacher proof curriculum, which he likens to a recipe, because it undermines the teacher's judgment. Eisner (1991) says curriculum is not a recipe to be followed, because every teacher, student and classroom is different. This curriculum product is not designed for incapable teachers who lack the skill or knowledge, but instead it is a "survivor's guide" for new faculty teaching a new course. Eisner and I have different views of "recipes". I have always enjoyed using a recipe and then over time, adapting that recipe to my personal tastes (such as adding milk instead of water,

or cinnamon for a little flavor). Therefore, I will design this curriculum to be a "recipe" that includes detailed assignments with grading rubrics and identified goals and objectives. However, both experienced and inexperienced educators should adapt or change as necessary to meet their teaching style and the needs of the students and the organization.

One of the hardest tasks when teaching a new course is the development of learning objectives and aligning those objectives to existing curriculum requirements. Because of the importance and difficulty associated with connecting objectives with learning activities, this curriculum will include goals, competencies, and objectives adapted from multiple sources. These student learning outcomes will be discussed in Chapter Two.

Knowledge

Regardless of the motivation or constraints, there are two types of knowledge an author must possess to write a textbook: content knowledge and pedagogical knowledge (Shulman, 1986; see also Lee and Catling, 2016). Content knowledge is further divided into pedagogical content knowledge and curricular knowledge.

Pedagogical Knowledge. According to Shulman (1986), pedagogical knowledge "is the generic principles of classroom organization and management" (p. 213). This curriculum will be designed utilizing the constructivist approach (discussed in Chapter Two). Constructivism can be referred to as student-centered, problem-based, or inquiry-based learning where more emphasis is placed on authentic learning and the skills used and developed during the learning process than rote memorization (Altun & Buyukduman, 2007; Bostock, 1998; Cotterill, 2015; Krahenbuhl, 2016).

Benhur Oral (2013) says textbooks are beneficial because of their organization but textbooks are static in a dynamic learning environment (p. 327). In a constructivist classroom that emphasizes critical thinking and personal experience, textbooks can be seen as a detriment. In a study in the UK, geography textbook authors reported that textbook publishers find inquiry-based courses to be difficult for teachers to implement (Lee and Catling, 2016). However, it is the intention of this text to provide sufficient guidance for teachers to successfully implement a student-centered, inquiry-based approach to teaching Aviation Human Factors. A textbook can be designed with the individual student's development in mind, it just must be prescriptive in the explanation of the learning activity (Khutorskoi, 2006). Khutorskoi (2006) says the first step in designing a textbook is to determine the educational philosophy, in this case constructivism, which will be discussed in Chapter Two.

Content Knowledge. As per the AVT 340 Aviation Human Factors course description in the Kansas State University Undergraduate Course Catalog (2023), educators teaching this course require subject content knowledge in health, fatigue, human error, communication, Crew Resource Management (CRM), teamwork, leadership, situational awareness, judgment and aeronautical decision making.

Pedagogical Content Knowledge. Pedagogical content knowledge includes knowing how to structure the information for teaching and areas that may confound students (Shulman, 1986). This knowledge can be particularly difficult for teachers teaching a course for the first time. Aviation is unique compared to other industries and academic programs because it utilizes both education and training. Flight training and associated academic courses can predict how students will utilize the knowledge to complete tasks (Posner, 2004, p. 70). Since CRM in the US aviation

industry is typically individualized to each airline (Advanced Qualification Programs introduced in 1990), and academic programs teaching CRM can utilize the accepted behaviors described in the Advisory Circular 120-51E Crew Resource Management Training (Federal Aviation Administration [FAA], 2004), CRM is best described as training. Education on the other hand includes teaching knowledge whose usage cannot be precisely predicted (Posner, 2004, p. 70). Since human factors or CRM courses in higher education often include more than just flight students, and even those students will use this knowledge in unpredictable ways, it is imperative to concentrate on the broader application of these concepts.

Curricular Knowledge. Curricular knowledge is concerned with two things: curriculum materials and curriculum integration (Shulman, 1986). Teachers should know about the different curriculum materials available and when they would best be used. Curriculum knowledge also includes understanding how each course fits into the overall curriculum, both laterally and vertically.

Organization of the Study

Chapter Two will explore the conceptual framework that informed the content analysis research and design of the textbook. The conceptual framework consists of Crew Resource Management, Accident Causation Models, Airmanship, and Constructivism. Chapter Three provides details on how the coding framework was designed and applied along with information regarding the outcome of the framework reviews and includes the findings of the full study.

Chapter 2 Conceptual Framework

Human error is a contributing factor in up to 80 percent of aircraft accidents (FAA, 2004, p. 4; Wiegmann and Shappell, 2003, p. 2). Typically, human error is associated more with non-technical skills than technical skills. This curriculum product will provide a prescriptive course curriculum primarily designed to help educators, new to teaching or new to teaching aviation human factors to provide a student-centered environment. The conceptual framework which guided the content analysis and the framework underpinning the development of the curriculum product are not entirely the same. However, there is considerable overlap between the two. The concepts that provide the foundation for this project include the educational concepts of constructivism, the development of learning objectives, and learning activities. The objectives identified as important to the aviation industry were also included in the content analysis in Chapter Three.

Eisner (1991) identifies several types of curricula; intended, operational, implicit, null, and experienced. The educator's plan is the intended curriculum and since even the best laid plans often drift from intention, what occurs in the classroom is referred to as the operational curriculum. The implicit curriculum includes the unspecified objectives, such as attention to detail, punctuality, and perseverance that are re-enforced by policies and procedures. Since it is not possible (or practical) for education to teach everything, and some objectives must be eliminated through the review process, what is not taught is the null curriculum. But, perhaps the most important curriculum, is that which is experienced by the student.

This text can only address the intended and null curriculum. The operational, implicit, and experienced are up to each teacher and student. Designing the intended curriculum be it a lesson, a course, or a whole program must first start with the identification of the underlying

educational philosophy that will influence all decisions, followed by the development of learning objectives and learning assessment.

Constructivism

Only learning objectives that align with and support the educational philosophy are kept, all others are eliminated and constitute the null curriculum. The educational philosophy underlying the design decisions of this text is constructivism. Traditional education treats students as "empty vessels" waiting to be filled by the teacher's knowledge (Eisner, 1991). This filling is done through lectures and assessed using traditional methods such as tests that focus on maximizing the knowledge the student can obtain and repeat. On the other hand, constructivism is a curricular approach that focuses on the individual learner (Altun & Buyukduman, 2007; Bostock, 1998; Cotterill, 2015; Krahenbuhl, 2016). For this reason, constructivist methods can often be referred to as student-centered learning, whereas traditional education is typically referred to as teacher or discipline centered. Within constructivism, more emphasis is placed on the skills used and developed during the learning process than the immediate recall of facts.

There is not a unified constructivist theory (Krahenbuhl, 2016; Lee and Hannafin, 2016), although a literature review shows it can be traced back to the contributions of several different people (see Table ##). Each of these gentlemen had a profound and sometimes contrasting impact on what is the current day "constructivist" method, or rather methods. Their ideas were used to develop the constructivist approach used in this project; Constructivism is an educational approach that emphasizes the development of reasoning and judgment by stimulating students' intrinsic motivation and utilizing authentic assessment to evaluate learning.

Contributors	Immanuel Kant	John Dewey	Jean Piaget	Lev Vygotsky

Altun & Buyukduman, 2007		x	x	
Golding, 2011		x	x	x
Krahenbuhl, 2016		x		
Lee & Hannafi, 2016		x	x	x
Posner, 2004	x			
Roksa et al., 2016				x
Terwal, 1999		x	x	
Schweitzer & Stephenson, 2008		x		x

Immanuel Kant (1899/2003) believed that children would learn more thoroughly if allowed to learn independently (p. 43). He advocated for designing learning activities that required "superior faculties," such as reasoning and judgment (Kant, 1899/2003, p. 79). Kant believed these skills have more educational value than simply memorization. However, reasoning and judgment do not spontaneously develop require explicit instruction (Sweller, 2009).

Piaget echoed this sentiment. He believed that children did not have the same mental structure as adults and therefore learning activities should support the development of their cognitive abilities (Piaget, 1969, p. 153, 160). Education requires students to adapt to new knowledge by assimilating it into their existing mental structures. Dewey (1938) also held this belief in what he called the principle of continuity, which stated that what was learned would build on previous knowledge.

This previously gained knowledge is the students' current level of development. Vygotsky's (1978) Zone of Proximal Development (ZPD) is "the distance between the actual

developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86). Through guidance such as scaffolding and Socratic Questioning students can achieve more than they can independently. Because of this Vygotsky (1978; Pass, 2004) emphasized the importance of interacting with others however, Kant (1899/2003) and Piaget (Pass, 2004) both concentrated on the individual.

Dewey (1938), Kant (1899/2003), Vygotsky (1978), and Piaget (1968) all agreed that learning was an active process, not a passive one. The word play is sometimes used to describe this activity, but Vygotsky (1978) argued that the activity does not have to be entirely pleasurable for the learner. Vygotsky (1978) uses the example of running a race, the process may not be particularly pleasurable, but the participant can take pleasure in the end result. The purpose of the activity should provide the motivating force, not necessarily the pleasure derived from it. At the same time Piaget (1968) stressed that active education does not mean that students can do anything they want, only that they should act and not simply be acted upon by an outside force.

Dewey (1938) proposed the idea of interaction in which progressive education had to balance forces internal to the learner and external forces (the teacher, books, and other). Vygotsky (1978) and Dewey (1938) both acknowledge the need for rules to manage behavior. Dewey (1938) argued that freedom may not be found in an individual activity but may instead be found in the continuity of learning. Meaning that by placing rules and restrictions on the learning the educator can control what they learn and when to ensure they learn what they should when they need to. Windschitl (2002) states that one of the reasons constructivism may not be

successful is too much emphasis on the activity without making it clear what the activity was meant to teach or what students learned from it.

Constructivism requires the teacher to take a step back from the typical role of expert and guide and facilitate students through the learning process (Altun & Buyukduman, 2007, p. 31; Cotterill, 2015, p. 407; Roksa et al., 2017, p. 287). John Sweller (2009), a proponent of constructivism argues against minimal instruction since students do not think like experts and cannot do as experts. This is true, students are novices and cannot think like experts without guidance. “The child, however, must also learn to distinguish clearly between knowledge and mere opinion and belief” (Kant, 1899/2003, p. 75). Without guidance, students may “learn” incorrectly (Duffy & Raymer, 2010; Krahenbuhl, 2016) or become frustrated with the process.

Students’ previous experiences not only provide a foundation to build more knowledge, but can also act as a barrier, negatively impacting their openness to constructivism. For constructivism to work, educators must have the support of their administration to face potential opposition from students and other education stakeholders (Windschitl, 2002). Students who are more accustomed to the traditional educational environment may view constructivism as high risk (Posner, 2004; Windschitl, 2002, p. 148). These students must be motivated to participate actively in a constructivist environment (Cotterill, 2015; Krahenbuhl, 2016; Roksa et al., 2017). The constructivist course must arouse the students' intrinsic motivation to learn for learning's sake and not solely to pursue good grades (Cotterill, 2015; Krahenbuhl, 2016). Student learning is aided by activities that allow students to see the connection between the classroom and the real world and provide students the opportunity to practice outside the classroom (Tyler, 2013). This need to stimulate student motivation is also reflected in Dewey’s concept of interaction in which

the educator must balance the internal and external factors working on the student (Dewey, 1938). These internal forces can be what drives a student.

Student Learning Objectives

The educational philosophy should help determine the expected outcome of the learning process. Student learning objectives grow out of the identification of aims and goals (Eisner, 1991, p. 135). Eisner (1991) defines aims as general statements that identify the organization's values. Goals are more specific than aims, but not as specific as objectives. University mission statements are a good example of a goal.

Eisner (1991) uses the term objective to refer to expected behaviors that are defined in advance, and outcomes to refer to behaviors that are defined after learning takes place (p. 117). Behavioral objectives are measurable and can be used in evaluation of the course and the students. These objectives need to include a description of the behavior, the conditions for the behavior, and the performance criteria (Bowen & Watson, 2015, p. 9; Eisner, 2013, p. 46 & 109). Clear objectives can provide better organization for making curriculum decisions. These specific objectives provide clear expectations for students. Problem-solving objectives on the other hand are more general and do not have one right or wrong answer (Eisner, 2013, p. 118).

According to Eisner (1994) behavioral or performance objectives requires the behavior and the content to be defined (p. 109). Anderson and Krathwohl (2001) believes the term knowledge should be substituted for content and provides two reasons. The first reason is because "subject matter content is 'historically shared knowledge' that is arrived at through a currently shared consensus within a discipline and is subject to change over time…" (p. 13). The second reason is "to differentiate the subject matter content of an academic discipline from the materials in which the content is embedded…" (Anderson & Krathwohl, 2001, p. 13). Anderson

and Krathwohl (2001) also substitutes the word behavior with cognitive process to minimize confusion with “behaviorism”.

To design objectives, a balanced curriculum relies on knowledge from three areas: the individual (needs of the student), the subject matter expert, and society (Tyler, 1949). Each source of knowledge in turn provides learning objectives. According to Tyler (2013), the learning objectives derived from the three knowledge areas are filtered through the educational philosophy (constructivism in this case) and only the relevant objectives are retained. What is filtered out and therefore not included is the null curriculum.

Contemporary Society

It is vital for education to meet the needs of the students; however, those needs must be tempered with the knowledge and skills deemed important by society and subject matter experts (Tyler, 1949). For the purposes of developing objectives, “society” included Aviation Accreditation Board International (AABI) outcomes, National Association of Colleges and Employer (NACE) competencies, International Society for Technology in Education (ISTE standards), and FAA CRM curriculum topics. Since these knowledge areas are determined necessary by contemporary society and were used to develop student learning objectives, they were also included in the coding framework for the content analysis discussed in Chapter Three.

Aviation Accreditation Board International. AABI was created in 1988 and accredits collegiate aviation programs (AABI, n.d.-b). AABI currently accredits over 40 national and international schools, including Kansas State University (AABI, n.d.-a). The Accreditation Criteria Manual includes guidance for associates, bachelors, and graduate degrees (AABI Form 201, 2023). For bachelor’s degrees there are 13 criteria, and Criterion 3.3 Student Learning

Outcomes has 18 outcomes. These outcomes are divided into general and core outcomes. Several of the outcomes are not applicable to the study of human factors, however the following are:

3.3.1 General. Aviation programs MUST demonstrate that graduates are able to:

c. work effectively on multi-disciplinary and diverse teams;

d. make professional and ethical decisions;

e. communicate effectively, using written communication skills;

f. communicate effectively, using oral communication skills;

g. engage in and recognize the need for life-long learning;

i. use the techniques, skills, and modern technology necessary for professional practice;

3.3.2 Aviation Core

3. Evaluate aviation safety and the impact of human factors on safety. p. 18-19.

National Association of Colleges and Employer. NACE was founded in 1956 and is dedicated to enhancing the career opportunities of college graduates through research and education (NACE, n.d.-b). The following NACE Career Readiness Competencies are relevant to the framework:

1. Career and Self-Development – "Proactively develop oneself and one's career through continual personal and professional learning, awareness of one's strengths and weaknesses, navigation of career opportunities, and networking to build relationships within and without one's organization." (NACE, n.d.-a, p. 10).

2. Communication – "Clearly and effectively exchange information, ideas, facts, and perspectives with persons inside and outside of an organization." (NACE, n.d.-a, p. 10).

3. Critical Thinking – "Identify and respond to needs based upon an understanding of situational context and logical analysis of relevant information." (NACE, n.d.-a, p. 11).

4. Equity and Inclusion – “Demonstrate the awareness, attitude, knowledge, and skills required to equitably engage and include people from different local and global cultures. Engage in anti-racist practices that actively challenge the systems, structures, and policies of racism.” (NACE, n.d.-a, p. 11).

5. Leadership – “Recognize and capitalize on personal and team strengths to achieve organizational goals.” (NACE, n.d.-a, p. 12).

6. Professionalism – “Knowing work environments differ greatly, understand and demonstrate effective work habits, and act in the interest of the larger community and workplace.” (NACE, n.d.-a, p. 13).

7. Teamwork – “Build and maintain collaborative relationships to work effectively toward common goals, while appreciating diverse viewpoints and shared responsibilities.” (NACE, n.d.-a, p. 13).

8. Technology – “Understand and leverage technologies ethically to enhance efficiency, complete tasks, and accomplish goals.” (NACE, n.d.-a, p. 14).

International Society for Technology in Education. ISTE advocates for the the use of technology in education (ISTE, n.d.-b). ISTE standards appropriate to the content analysis are:

4. Innovative Designer – “Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.” (ISTE, n.d-a, Innovative Designer section).

5. Computational Thinker – “Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.” (ISTE, n.d-a, Computational Thinker section).

6. Creative Communicator – “Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.” (ISTE, n.d-a, Creative Communicator section).

7. Global Collaborator – “Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.” (ISTE, n.d-a, Global Collaborator section).

Crew Resource Management. Simply put, CRM is the “effective use of all available resources” to ensure the safety of flight (FAA, 2004, p. 2). These resources can be internal to the aircraft (other crew members, manuals or instruments) or external (Air Traffic Control, other pilots, company dispatch). Most often CRM is discussed in terms of the aircraft cockpit, but it is important to keep in mind that the principles can be applied to any working environment such as a maintenance hangar or an office setting.

The concept of CRM has evolved through decades of updates and adjustments in response to advancements in safety thinking and accident investigations. Although pilots did not embrace the tenets of CRM in the beginning, likening it to “charm school”, thinking it stripped the captains of authority, it has since proven its effectiveness (Helmreich, 1999). In the 90s, human factors was added to CRMs other error management strategies. CRM training addresses technical and nontechnical skills such as “team building and maintenance, information transfer, problem solving, decision making, maintaining situation awareness, and dealing with automated systems.” (FAA, 2004, p. 2). To that end, the FAA (2004) recommends several key curriculum topics that should be included in CRM Training:

a. Communications Processes and Decision Behavior

    1. Briefings

2. Inquiry/Advocacy/Assertion
3. Crew Self-Critique (Decisions and Actions)
4. Conflict Resolution
5. Communications and Decision making

b. Team Building and Maintenance
    1. Leadership/Followership/Concern for Task
    2. Interpersonal Relationships/Group Climate
    3. Workload Management and Situation Awareness
        a) Preparation/Planning/Vigilance
        b) Workload Distribution/Distraction Avoidance
    4. Individual Factors/Stress Reduction

Subject Matter Experts

Subject matter experts (SME) in the topic area have a significant impact on the development of educational objectives and the design of learning experiences because they are the ones that write the textbooks (Tyler, 2013). Content area experts and industry members were included in the knowledge area "contemporary society" therefore this knowledge area is dedicated to educational specialists. Recall from Chapter One, an educator must demonstrate content knowledge and pedagogical knowledge (Shulman, 1986). According to the 2023-2024 Kansas State University Course Catalog description, the AVT 340 Human Factors in Aviation course:

> Explores the physical environment and physiology limitations imposed on the aviation professional. Health, fatigue, human behavior and errors, communication, team building,

leadership, situation awareness, crew resource management, judgment, and aeronautical decision making are studied to achieve safe and efficient operation.

The course catalog description provides a list of the content knowledge the instructor of the human factors course requires. The knowledge of the subject matter expert was also exercised by the inclusion of other topics into the content analysis coding framework that were not developed from another source. See Chapter Three for further details.

Needs of the Student

The needs of the student includes two different types of needs (Tyler, 1949). The first set of needs are related to healthy living such as physical needs, social needs, and integrative needs. The second type of needs is what educators are most concerned with, the gap between what students currently know or can do and what they need to know or be able to do. This gap must be considered when developing learning activities. Knowing students's current level of development is paramount for meeting their needs but, according to Dewey (1938) as students mature their previous experience and knowledge of the subject matter become harder to ascertain. However, utilizing Vygotsky's (1978) Zone of Proximal Development, learning activities should not be designed at the students' current level of development, but instead designed to allow them to continue to grow and reach new levels of development (Dewey 1938; Vygotsky, 1978).

In Vygotsky's (1978) Zone of Proximal Development (ZPD) the educator scaffolds the students' learning and uses questioning to guide students. When the educator takes on the role of guide, students must take on a more active role in the learning process (Grabinger & Dunlap, 1995; Roksa et al., 2017, p. 287) and take responsibility for their learning (Lee & Hannafin,

2016). The appropriate scaffolding in the ZPD will lead to student success and increased confidence (Roksa et al., 2017, p. 287).

Overall learning requires a cumulative effect from all the individual learning experiences. One individual activity is not sufficient for students to be introduced to, practice, and be assessed on learning objectives (Tyler, 2013, p. 83). This accumulation of knowledge requires the integration of learning activities both horizontally and vertically. Jerome Bruner (1960) developed the spiral curriculum which requires teaching students the fundamentals of a subject by allowing students to make connections between the elements (p. 7). By enabling students to make connections students can then apply this knowledge to new situations, referred to as "transfer of principles and attitudes" (Bruner, 1960, p. 17 & 18; Tyler, 2013, p. 31). Dewey (1938) had a similar concept, referred to as continuity. Continuity refers to the traits of learning activities that allow the student to build on previous learning.

Organization. Students perform better in courses that are well organized (Roksa, 2017). Unfortunately teachers do not always have the luxury of time to plan a course before implementing. This can lead to frustration with the course structure. One framework that supports well organized assignment instructions, that can be utilized even if the course is being implemented at the same time it is being designed, is the TILT Higher Ed Transparent Assignment Framework. The TILT Transparent Assignment framework is not considered prescriptive, each instructor is encouraged to provide information in the format they find most appropriate which may be written, oral or both (Wilkhelmes, 2019).

The TILT guidelines include providing students with the purpose of the assignment, tasks, and the criteria for success (Wilkhelmes, 2019). The purpose section provides an overview of what the assignment seeks to accomplish and the learning objectives. The Task section of a

Transparent Assignment Overview covers the steps a student should follow or avoid. The Criteria for Success includes the grading requirements which may include a rubric and examples. Since the framework is not prescriptive, there are not guidelines beyond the basic assignment layout, resources such as *Procedure writing: Principles and practices* by Douglas Wieringa, Christopher Moore, and Valerie Barnes or the FAA's *Advisory Circular 120-71 Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers* can provide helpful guidance on formatting.

When designing learning activities, the curriculum designer should remember that students in the same classroom will not experience the learning activity the same. Tyler (2013) advocates five principles for selecting learning experiences:

1. For students to achieve the objectives they must be provided the chance to develop those skills in the same manner they will be evaluated and will be expected to use those skills in the real world.
2. Students must derive "satisfaction" from the experience (p. 66).
3. Students must be capable of accomplishing the objective of the learning experience.
4. More than one experience can support the same objective(s).
5. One learning experience can have multiple objectives.

Note that students must be capable of achieving the objective. Notice the use of the word "satisfaction" and not pleasure. The student should be satisfied by what they have accomplished and their continued development. Students also do not derive satisfaction from learning if they do not understand the basic principles and are more likely to forget information they cannot relate to other knowledge (Tyler, 2013, p. 31). Teaching the fundamentals allows students to reconstruct knowledge later, if they do forget (Bruner, 1960, p. 23). Meaning if students

understand the underlying concepts of how something works, they can think their way to the answer (assuming they were taught problem solving and critical thinking).

Tyler (2013) identified five defects in student learning; 1) students learn by memorizing discrete facts and not by understanding the material, 2) students typically forget large amounts of information quickly, 3) because students learn by rote memorization they are unable to organize those discrete facts into a framework, 4) students do not remember exactly what they have been taught, and 5) students are unable to identify appropriate sources of information (p. 72). Recommendations for addressing Tyler's defects include focusing only on what is important, cover those items frequently, vary the learning experiences, make sure the experience is intense, and require students to participate in problem-solving (Tyler, 2013, pp. 73-74).

Problem-solving activities should require students to combine multiple sources of information to develop a solution (Tyler, 2013, p. 69). Bruner (1960) thought learning should include an attitude of inquiry and excitement toward discovery (p. 20). Tyler (2013) refers to problem solving experiences as "more economical" because they require students to obtain the knowledge as they are finding the solution, and they are less likely to "result in rote memorization" (p. 73).

Inquiry-based learning (IBL) is one category of learning activities that utilizes problem-solving and can include multiple different specific types of learning activities (Biggs et al., 2022; Duffy & Raymer, 2010). In IBL the problem must be authentic, requiring students to solve a real-world problem (Biggs et al., 2022; Duffy & Raymer, 2010; Tyler, 2013). According to Eisner (1991) authentic assessment requires:

1. The tasks used to assess what students know and can do need to reflect the tasks they will encounter in the world outside of schools, not merely those limited to the schools themselves.
2. The tasks used to assess students should reveal how students go about solving a problem, not only the solutions they formulated.
3. Assessment tasks should reflect the values of the intellectual community from which the tasks are derived.
4. Assessment tasks need not be limited to solo performance. Many of the most important tasks we undertake require group efforts.
5. New assessment tasks should make possible more than one acceptable solution to a problem and more than one acceptable answer to a question.
6. Assessment tasks should have curricular relevance, but not be limited to the curriculum taught.
7. Assessment tasks should require students to display a sensitivity to configuration or wholes, not simply to discrete elements.
8. Assessment tasks should permit the student to select a form of representation he or she chooses to use to display what has been learned. (pp. 203-209)

A review of contemporary society to design objectives means only including the knowledge and skills current students require, and eliminating the inefficiency of teaching students things that are no longer relevant (Tyler, 2013). Utilizing contemporary society as a source of knowledge also allows for the development of real-world examples and learning experiences that can improve student learning and motivation. Allowing students to practice the learning in the same context they would be expected to demonstrate that knowledge in the real

world, requires students to do as the experts do (Bruner, 1960, p. 30). Learning in a purely academic environment that does not relate to the real world will not be retained long by students.

Student Learning Assessment. Some constructivists may argue that for assessment to be authentic, it must be subjective and not quantifiable (Altun & Buyukduman, 2007, p. 3). However, vague assessment criteria can be difficult for students to apply to their work, so they prefer more quantifiable objectives (Worth, 2014, p. 364, Orr & Blythman, 2005 as cited in Worth, 2014). Well defined behavioral objectives also aid in the objective evaluation of students. Unfortunately, when grading criteria are more subjective than objective, students tend to get frustrated since they may not know what is expected.

Student assessment criteria can be organized into a rubric which is a matrix consisting of content areas and performance levels. According to Panadero and Jonsson (2013; 2020), rubrics can be holistic (all criteria are considered as one), analytical (all criteria are considered separately), generic (applicable to different tasks or contexts), or task specific.

Rubrics can improve student performance by increasing transparency, reducing anxiety, aiding the feedback process, improving student self-efficacy, and supporting student self-regulation (Panadero & Jonsson, 2013, p. 138). There is some concern that quantifiable grading criteria may provide a checklist (Worth, 2014) and may negatively impact the students' deeper learning (Torrance, 2007; 2012 as cited in Ponadero & Jonsson, 2020). The effect that assessment methods have on student learning strategies can be referred to as backwash (Biggs et al., 2022, p. 188). Most often this has a negative connotation, in which traditional assessment methods such as standardized tests, encourage students to utilize test taking strategies over learning the material.

However, Biggs et al. (2022) argues that backwash can be a positive if the assessment method encourages deeper learning. Deeper learning can be facilitated by constructively aligning rubrics with student learning outcomes and learning activities (Biggs et al., 2022). Biggs et al. (2022) argues for a holistic approach to rubric development. They use the example of someone performing surgery, the cuts may be perfect and other elements done as expected, however if they cut off the wrong body part the task should be a failure.

Rubrics are also beneficial in ensuring reliability (Biggs, et al., 2022, p. 208). Inter-rater agreement can be increased by limiting the number of performance levels, but reliability can be improved with more levels (Panadero and Jonsson, 2020). Rubrics ensure reliability by providing clear expectations and evidence for assessment (Biggs, et al., 2022).

Collaboration. According to Vygotsky's social constructivism, collaboration and cooperation with the teacher and peers is used to build knowledge and understanding (Altun & Buyukduman, 2007; Krahenbuhl, 2016; Vygotsky, 1978). The social aspect of constructivism can support the AABI, NACE, ISTE, and CRM components related to teamwork.

Collaboration cannot just be limited to group projects but should also be utilized in class discussions. Kintsch (2009) argues that students will learn deeper if they read to participate in a class discussion versus reading to pass a test (p. 225). Vygotsky (1978) believed learners could reach higher levels of development with help from others. Students may expand their knowledge and understanding by listening to the ideas of their peers. Teachers can also use the Socratic method to guide students through discovery (Kant, 1899/2003, p. 81).

According to Golding (2011), class discussions can lay anywhere along a continuum, from student directed to instructor directed. These discussions can guide students to the "correct" answer or lead them through the process of discovering what the knowledge means to them. Less

guidance during the discussion can lead to a distinct lack of progress in the discussion (Golding, 2011).

At the very minimum, the instructor's feedback on assignments should constitute a social interaction designed to help the student progress. Even while working to motivate students intrinsically, educators cannot forget they will remain (if only slightly) extrinsically motivated by grades (Worth, 2014). Instructor feedback should be constructive and provide students with a path forward.

Alignment between Objectives, Learning Activities, and Assessment

There are innate contradictions between educational approaches such as constructivism and traditionalism (Windschitl, 2002), which can lead to misalignment between learning objectives, learning activities, and student assessment (Biggs et al., 2022). There are two frameworks that can be used to ensure alignment between objectives and learning activities; Constructive Alignment by Biggs et al. (2022) and Revised Bloom's Taxonomy from Anderson and Krathwohl (2001).

Biggs et al., (2022) describes three elements for aligning outcomes to assessment; intended learning outcomes, teaching/learning tasks, and assessment tasks. To ensure alignment the teacher starts with the outcomes, then identifies learning tasks and finally identifies assessment tasks. However, because many teachers do not have the resources to fully plan a course before implementation, the process identified by Biggs et al. (2022) can be used to retroactively check for alignment and identify any need to adjust objectives or tasks.

The Revised Bloom's Taxonomy by Anderson and Krathwohl (2001) should be used to identify the objective's appropriate cognitive process and type of knowledge before

implementation. But it can also be used retroactively. This taxonomy consists of a matrix, with the type of knowledge students are expected to exhibit, plotted against the cognitive process they are expected to utilize. The knowledge dimension is designated by letters, A-D. Factual knowledge corresponds to the letter "A" and refers to discreet facts. Conceptual knowledge (B) "includes knowledge of categories and classifications and the relationships between and among them" (Anderson & Krathwohl, 2001, p. 48). Procedural knowledge (C) is the knowledge of processes or steps of how to do something. The last position, D is for Metacognitive knowledge which refers to knowledge about cognition.

Table 2-1
Anderson and Krathwohl (2001) revised

Bloom's taxonomy.

Knowledge Dimension	Cognitive Processes
A. Factual Knowledge	1. Remember
B. Conceptual Knowledge	2. Understand
C. Procedural Knowledge	3. Apply
D. Metacognitive Knowledge	4. Analyze
	5. Evaluate
	6. Create

Across the top of the matrix there are six cognitive processes. Remembering is identified as number 1 and emphasizes retention, whereas positions 2-6 focus on knowledge transfer (Anderson & Krathwohl, 2001, p. 64). Positions 2-6 are held by "Understand", "Apply", "Analyze", "Evaluate", and "Create" respectively. Table 2-1 shows the Knowledge Dimension and Cognitive Processes.

Conceptual Framework for Successful Student Learning

A successful curriculum requires an understanding of the expected learning outcomes and the educational approach meant to bring about those outcomes. In aviation future professionals cannot just be trained with technical skills but must also be educated in non-technical skills. Contemporary society, the needs of the student, and subject matter experts provide student learning objectives which must be filtered through an educational philosophy so that only the relevant objectives are maintained. This helps to ensure alignment when learning activities and assessment tasks are developed.

Chapter 3 Content Analysis

As previously discussed, textbook prices can be cost-prohibitive, and students do not always adhere to reading requirements in a course. These issues can be compounded by commercial texts that have to be supplemented by other resources to meet the individual needs of the course or the educational program. Therefore, it becomes imperative to determine what makes a text more appropriate for use in the college classroom than other books available. That information can then be used to identify which elements are most important for designing a new textbook.

Research Questions

To determine if a new aviation human factors textbook is necessary, a content analysis of current commercially available books was conducted. This content analysis answered two questions.

Research Question 1: Which of the necessary topics do the commercially available aviation human factors books include and exclude?

Research Question 2: What pedagogical aids were present in the commercially available aviation human factors books?

Sampling and Analysis Sources

Three types of units are essential in content analysis: sampling units, recording/coding units, and context units (Krippendorf, 2019, p. 122). Relevance sampling was selected for this analysis which chooses relevant materials that "contribute to answering the research questions" (Krippendorf, 2019, p. 122). Sampling validity requires the sample to represent the appropriate population of texts (Krippendorf, 2019). The materials chosen for this review did not represent all of the human factors texts available. Instead, they are a sample of the texts that meet the

research question and focus of the research (covered in Chapter 1 “Delimitations”). The recording unit, portions of the text analyzed individually and used to make the final inferences in this study, will be the individual chapters in each text (Krippendorf, 2019, p. 104).

The collection of texts for this analysis started on Amazon.com by searching “aviation human factors” and limiting the search to books. From that search, I ordered ten books, including *Aviation Psychology and Human Factors* by Martinussen and Hunter (2018) and *Human Factors in Multi-crew Flight Operations* by Orlady and Orlady (1990). *Practical Human Factors for Pilots* by Moriarty (2015) was also included since it is already in use by some sections of the course. Other sources were excluded because they were collections of articles in edited books or had a narrow focus. A full description of each book considered and why they were omitted is covered in Appendix D.

Research Design

Assessing the significance and impact of the written word utilizes a method referred to as content analysis. According to Krippendorf (2019), “content analysis is a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use” (p. 24). Content analysis can be qualitative or quantitative. In this case, both qualitative and quantitative methods will be used. Identifying which source is more appropriate for use in a college classroom will require a quantitative analysis of how many of the necessary topics are covered and a qualitative analysis of how deep those topics are covered.

Chu (2017) found that less than half of the 29 content analyses reviewed in a meta-analysis “explicitly stated [a] theoretical network” (p. 235). Content analysis requires establishing a coding framework by identifying the critical ideas, topics, or words that may be

used within the text (Krippendorf, 2019). These codes must align with the conceptual framework or frameworks previously defined as the purpose of the research.

As previously discussed, commercially available textbooks often do not meet the individual needs of the teacher, school, and students since each educational program has unique learning requirements. For instance, the Professional Aviation Flight Technology degree option at Kansas State University is accredited by the Aviation Accreditation Board International (AABI), but not all flight programs are. Even though Crew Resource Management (CRM) is a regulatory requirement in the United States (FAA, 2004), its evolution and significance in shaping human factors is not always explored in other textbooks.

Coding Frame

Chu (2017) found that 79% of the content analysis studies reviewed did not explain how they had developed their coding variables. My coding frame consists of four dimensions with varying subcategories.

To establish the coding framework, I started with the Kansas State University Course Catalog description of the Aviation Human Factors course to identify specific content areas the course must cover. From there, a list of nine required subcategories of this dimension was developed: aviation physiology, human behavior, human error, communication, team building, leadership, situational awareness, Crew Resource Management, and decision-making.

Other vital objectives were synthesized from overlaps in the ISTE Standards, NACE Career Readiness Outcomes, and AABI Outcomes. This synthesis identified ten subcategories of objectives: personal and professional development, critical/creative thinking, written communication, oral communication, socio-cultural diversity, leadership, professionalism, teamwork, technology, and ethics.

Eleven subcategories were found in the FAAs (2004) Crew Resource Management Advisory Circular; briefings, inquiry/advocacy/assertion, Crew Self-Critique (Decisions and Actions), conflict resolution, communications and decision making, leadership/followership/concern for task, interpersonal relationships/group climate, workload management and situation awareness, preparation/planning/vigilance, workload distribution/distraction avoidance, interpersonal factors/stress reduction.

Schreier (2012) stresses the importance of objectively evaluating the text using the coding frame and comparing the texts to each other, allowing the coding frame to 'emerge' as you go through the material, which promotes flexibility. To that end, another category of "Other topics" was added to the coding framework so that as important topics arise, each text can be reviewed for that topic. This approach requires an almost continuous re-review of the sources to ensure that each previous source was evaluated on new topics. Therefore, if a new topic emerges, it is paramount to review the sources analyzed previously for that topic. The additional topics identified were NOTECHs, Introduction to human factors, accident causation models, standard operating procedures, threat and error management, safety culture, and culture.

Data Collection and Analysis

The source coding was contained in a Microsoft Excel workbook with a worksheet for each source chapter (a separate worksheet was created for each review step as well). To ensure that spelling issues did not negatively impact the aggregate coding, I used data validation lists (drop-down lists) to choose the subcategories of each dimension on each worksheet. In addition to this coding method, I also outlined each chapter. The outline provides the context unit, by

providing context for the recording unit (Krippendorf, 2019, p. 105). The two pieces of the coding framework provide information regarding which dimensions/subcategories were or were not covered but also show the depth of the information contained in each text concerning each topic. These two pieces are vital for making a qualitative assessment regarding the appropriateness of each text.

Figure 3-1

Screen capture of Content Analysis Coding Frame Template.

	A	B	C	D	E
1	Source				
2	Chapter				
3	Chapter Title				
4					
5	Description 1				
6	Description 2				
7	Description 3				
8					
9	Objective 1				
10	Objective 2				
11	Objective 3				
12					
13	CRM 1				
14	CRM 2				
15	CRM 3				
16	CRM 4				
17					
18	Other Topic 1				
19	Other Topic 2				
20	Other Topic 3				
21					
22	Outline				
23	First Level	Second Level	Third Level	Key Terms	
24					

To compare each source to the other, I also created worksheets aggregating the description subcategories, objectives, CRM subcategories and other topics. Each source worksheet is identified with a source number (1, 2, 3, etc.), the chapter number, separated by a period, and when applicable the date of the review. This naming convention is somewhat complex but allows the excel formulas to locate each worksheet easily and aggregate the data. Since each source worksheet is identical to one another, the formula can easily locate the necessary information to extract. On another page, I have identified the presence of pedagogical aids, such as identifying chapter objectives, chapter outlines, key terms, review/discussion questions, and/or summary key points.

Final Coding Results

The final coding framework utilized in the study was developed through the initial framework (discussed previously), three separate reviews, a review by an independent rater, and periodic updates to account for emerging topics and comparisons between the texts. A timeline of the initial development, three reviews, and a rater review are included in Appendix A.

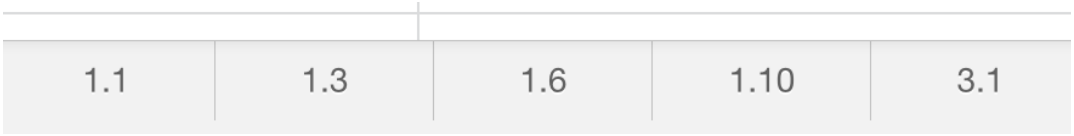
Table 3-1

Source Numbers

Source	Source Number
Martinussen, M & Hunter D.R. (2018). *Aviation Psychology and Human Factors*. CRC Press.	1
Moriarty, D. (2015). *Practical human factors for pilots*. Academic Press.	3
Orlady, H.W. & Orlady, L.M. (1999). *Human factors in multi-crew flight operations*. Ashgate.	4

Figure 3-2

Screen capture of worksheet names. Worksheet names are determined by the source number, followed by the chapter number, separated by a period.



None of the books reviewed covered every subcategory of each dimension. The third review of the material had a higher percentage of agreement for all chapters and the books. All but two chapters had 100% agreement. This was due largely because of the improved coding framework instructions with the decision rules and clearer definitions and added key terms developed after the second review. The results are shown in Table 3-2.

Table 3-2

Final Coding Results

Dimension	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Aviation Physiology	X	X	X
Human Behavior	X	X	X
Error	X	X	X
Communication		X	X
Team Building		X	X
Leadership	X	X	X
Situation Awareness	X		X
Crew Resource Management	X		
Decision Making	X	X	X
Personal and Professional Development			
Critical Thinking	X	X	X
Written Communication		X	X
Oral Communication		X	X
Socio-cultural Diversity	X	X	X
Leadership	X	X	X
Professionalism			
Teamwork		X	X
Technology	X	X	X
Ethics			
Briefings		X	
Inquiry/Advocacy/Assertion		X	
Crew Self-Critique (Decisions and Actions)	X		
Conflict Resolution		X	
Communications and Decision Making			
Leadership/Followership/Concern for Task		X	X
Interpersonal Relationships/Group Climate		X	X
Workload Management and Situation Awareness			
Preparation/Planning/Vigilance			X
Workload Distribution/Distraction Avoidance			
Individual Factors/Stress Reduction	X	X	X
NOTECHS		X	
Introduction to Human Factors	X	X	X
Models	X	X	X
Threat and Error Management		X	

Safety Culture	X	X	
Culture	X	X	X
Aircraft Design/Systems	X	X	X

Trustworthiness

Establishing reliability and validity requires going about the research in a systematic and transparent manner (Schreier, 2012, p. 27). The reliability and validity of this study were ensured through various methods at different steps in the research process.

Reliability

Evidence for two types of reliability – stability and replicability, was provided during the data collection and analysis process. Stability was established by the test-retest method, where I analyzed a portion of the chapters and then re-analyzed them later. Reliability can be supported through replicability if another researcher can use the same coding instrument to find the same or similar results (Krippendorf, 2019). Replicability was ensured when my colleague used the same coding frame to analyze four chapters from *Practical Human Factors for Pilots* by David Moriarty (2015).

Test-Retest. To demonstrate stability, I tested the coding framework a total of three times. Schreier (2012) recommends reviewing the framework 10-14 days after the initial coding. Unfortunately, I was not able to return to the analysis until approximately six months after the initial coding. This second review had several differences from my first analysis. I utilized coefficients of agreement to compare the first and second reviews (Schreier, 2012, p. 170).

$$Percentage\ of\ agreement = \frac{Number\ of\ units\ of\ coding\ on\ which\ the\ codes\ agrees}{Total\ Number\ of\ Units\ of\ coding} \times 100$$

See Appendix G for details on how this was calculated in Microsoft Excel.

Schreier (2012) does point out some limitations of this method, such as establishing what agreements means. Agreement could mean agreeing not to mark a topic or only if the same topic was indicated as existing. For my analysis I only considered it agreement if the subcategory was indicated in both reviews. Changes between the reviews were marked as either "added" or "removed" to indicate if a new code was identified or if a code was removed in a subsequent analysis. I also considered "Total Number of Units Coding" to mean the highest number of codes identified for that chapter.

For instance, Chapter 3 of the Martinussen text was originally assigned Aviation Physiology and Interpersonal Relationships/Group Climate, but on my second analysis, Aviation Physiology and Individual Factors/Stress Reduction was identified. Since only one code matched from the first to the second analysis, this unit only had a 50% match.

$$50\% = \frac{1}{2} \times 100$$

Another example is Chapter 6 of the Orlady and Orlady text which had a 57% match because there were four topics identified on the first analysis, but three additional topics were identified on the second analysis.

$$57\% = \frac{4}{7} \times 100$$

As shown in Table 3-3 and Table 3-4 the number of chapters with an agreement percentage of 100% increased with the improved coding guidelines between review two and three. See Appendix E and Appendix F for an explanation of the first and second review results and Appendix G, Appendix H, and Appendix I for a breakdown of the percentages of agreement between the first and second reviews and Appendix K, Appendix L, and Appendix M for the second and third reviews.

Table 3-3
Percentage of Agreement between First Review and Second Review

Agreement Percentage	Number of Chapters
100%	7
90%-99.9%	0
80%-89.9%	0
70%-79.9%	1
60%-69.9%	4
50%-59.9%	3

Table 3-4
Percentage of Agreement between Second Review and Third Review

Agreement Percentage	Number of Chapters
100%	31
90%-99.9%	0
80%-89.9%	1
70%-79.9%	0
60%-69.9%	0
50%-59.9%	1

Inter-rater Review. The rater had the flexibility to choose which chapters they reviewed from the Moriarty text. The rater had access to the electronic version of the text through their school's library and reviewed chapters 5, 6, 7, and 8. There were considerable differences between the rater's analysis and the results from the third review. One chapter had 86% agreement, two had 67% agreement and one only agreed on 50% of the subcategories identified. Overall, the text had reliability of 56% when the percentage of agreement was calculated for each chapter, but 80% when calculated for the text overall.

The greatest number of disagreements revolved around the Course Catalog Description subcategory of Human Behavior. Through the journal the rater kept detailing why they identified each subcategory; I was able to determine that they identified more chapters that discussed how human behavior was impacted by other factors. This is an appropriate application of that code. The increased use of this subcategory did not change the overall final analysis of the textbook.

Other disagreements occurred around the Objectives subcategory Personal and Professional Development. Since the rater explained that at times the text was not explicit on this topic but instead it required the reader to make connections, a new decision rule was added to the coding framework, that this subcategory required the text to be intentional addressing this topic. The identification of this topic did change the overall analysis of the text.

To understand why some subcategories were not identified, an email was sent to the rater with follow-up questions regarding their analysis (see Appendix O). Through that discussion, the rater did make some adjustments to their analysis to identify topics they had marked as a key term but had missed marking the code for analysis.

Validity

Four types of validity, face, structural, semantic, and sampling, were shown by describing the coding framework and analysis process (see Appendix C for the Coding instructions and final definitions and key terms with decision rules). Structural validity requires evidence that the coding frame accurately portrays the concepts, ideas, and texts being analyzed. Face and structural validity were supported by evidence for how the coding categories and subcategories were developed through a synthesis of NACE, AABI, and ISTE objectives, evaluation of the course catalog description, and the FAA CRM curriculum topics. How the categories and

subcategories were defined ensured the coding framework stayed true to the meaning of the category and to the context of the material analyzed. Sampling validity is supported by the evidence of how and why the material for analysis was chosen.

Discussion of the Content Analysis Results

A discussion of the ultimate implications of this research first requires a discussion of what it will not do. This research will not have a widescale impact on how teachers assess textbooks. Most teachers do not have the time or resources to purchase multiple books and formally evaluate them. Nevertheless, it may change how a teacher reviews a new textbook. It is logical for a textbook adopter to compare the topics in a text to other texts and the course requirements (either a course description or course objectives). But how many thoroughly review the content contained in those topics instead of just reviewing the table of contents? A thorough review requires time that many do not have (especially if they are teaching the course at the same time).

Discussion of Overall Results

There were several subcategories that were never identified in any text, Objectives Subcategories Ethics, and Crew Resource Management Curriculum Topics Subcategories Communications and Decision Making, Workload Management and Situation Awareness, and Workload Distribution/Distraction Avoidance.

The results show that none of the included texts met all the requirements for my K-State Salina Aviation Human Factors course. The biggest deficiency was in the Objectives subcategories of professionalism and ethics. These two objectives were synthesized from the NACE Career Readiness Outcomes and AABI Outcomes. This result was unsurprising since the

AABI outcome “d. make professional and ethical decisions” and its lack of a department definition was one of the initial catalysts for this project. Although the independent rater did identify the Professionalism subcategory in Chapter 5 and 8 of Moriarty (2015), they also agreed that the text was not explicit on this topic, and it required the reader to make the connections (see Appendix O for the follow up conversation with the rater). Since it is not uncommon for a teacher to be assigned a new course that is on the periphery of their expertise, it is important for the textbook to make important learning connections clear to students. This becomes even more paramount in an online asynchronous course environment where students do not have the luxury of the instructor making the connections clear. Ethical decision making can take on a whole new meaning when pilots, mechanics, or air traffic controllers are responsible for a hundred or more lives on any given flight. Therefore, the absence of clarity for this topic is a huge drawback for these textbooks.

Based on the outline of the chapters, the lack of information for the CRM Curriculum Topics Subcategories Communications and Decision Making, Workload Management and Situation Awareness, and Workload Distribution/Distraction Avoidance appears to be more a lack of intentionality on the part of the authors, not an omission of pertinent information. Meaning these topics were addressed singularly, but not in partnership. According to the decision rules for these subcategories, both topics had to be discussed together, Communication and Decision Making, Workload Management and Situation Awareness, and Workload Distribution/Distraction Avoidance. It was not sufficient for the text to discuss communication in one section and then decision making in another, but the relationship between both concepts had to be clear. This may not seem to be a significant issue for an experienced teacher, however since

it is not unheard of for a low experience or an instructor experienced in another topic to be assigned new classes when there is a need to cover a course, this highlights the importance of a prescriptive text that is clear and meets all the course needs. Once the instructor gains the necessary experience to make their own connections or emphasis, then they can adapt the text. But until then, a guide to survive the initial course offering and meet the course requirements is necessary.

Discussion of Results From Each Source

Orlady and Orlady (1999) covered all the topics for the course catalog description, missing three subcategories from the objectives, only covered four of the necessary CRM curriculum topics, and four other topics. Given the fact this text predates the most recent update to the CRM advisory circular, the development of NOTECHS, Threat and Error Management, and other concepts, it is unsurprising these subcategories were not covered.

Since course catalog descriptions are relatively short and can be difficult to update, they can be simple and limited in the information contained. If the course catalog description was the only information used to choose a course textbook, then the Orlady and Orlady text would be the obvious front runner since it included all subcategories for the catalog description. However, one of the AABI objectives currently assessed in this course, “d. make professional and ethical decisions”, was not covered. This would require the instructor to supplement the text with additional resources.

The book currently used in multiple sections of the KSUS Aviation Human Factors course, Moriarty (2015) failed to address two subcategories of the course catalog description, situation awareness and crew resource management, only included six CRM subcategories, but

covered all the other topics. Moriarty may discuss all the other topics, because it is the book I first used when teaching this course and those topics were developed largely out of what other topics, I thought were important to cover that was not included in the other dimensions.

Moriarty (2015) specifically states “Many readers would expect [situational awareness] to have a place in the chapter on information processing, and my justification for leaving it out is based on the following: the subject is already amply covered by the sections on attention, perception and decision making.” (p. xxiv). While I do not discount the logic in excluding the term based on this explanation, again this is an intentionality issue for student learning. However, since this book was not designed for students as textbook (clearly stating “This book is not a textbook” [Moriarty, 2015, p. xx]), the lack of intentionality for novice learning is clearly explained.

The Moriarty (2015) text was the only one of the reviewed texts that had any pedagogical aids (see Appendix N), but the aids included were not the types of aids that Gurung (2003; 2004) and Weiten (1999) found to be most helpful or most likely to be used by students. Indeed, chapter outlines were one of the pedagogical aids found to be the least likely used by students (Marek et al., 1999, p. 15; Weiten et al., 1999, p. 106).

Martinussen and Hunter (2018) only covered seven description subcategories, four objectives, only two CRM Curriculum Topics, and five other topics. Almost 92% of the organizations surveyed by NACE in 2015 said Oral and Written Communication was “essential” or “absolutely essential” (NACE, 2022, p. 15) and in 2021 97% of students rated communication as “important” or “extremely important” (NACE, 2022, p. 21). Communication is a significant aspect of human factors for this text to omit. Industry professionals must communicate with

pilots, air traffic control, dispatch, ramp agents, and cabin crew to successfully carry out their duties. The assumption that “we all communicate” is not the same as “we all communicate effectively”. Methods of communicating, barriers to communication, and ways to improve communication is necessary for the growing professional to understand.

If the content in one text is insufficient to meet all the requirements and needs of the course, does the teacher require students to purchase multiple books, risk copyright infringement by providing copies to students, or do they write their own book? If an editable OER is available, that satisfies many problems, but unfortunately, OERs are not available for all topics, especially in aviation. This research project demonstrated that while researching and evaluating commercially available textbooks to write a unique text is time-consuming, it should result in a superior product for student learning. A product that is free to students and easily updatable to meet their various needs.

Limitations

The first and second reviews had significant implications for the final research. Writing up the coding instructions to satisfy reliability and validity emphasized the importance of providing a clear description of each category and subcategory of the coding frame. However, putting in definitions, key terms, and decision rules so that my colleague could vet the coding frame also provided the opportunity to ensure that those definitions and expectations stayed the same over time as I revisited each chapter. Completing the second review and comparing the findings highlighted additional needs to provide clearer guidelines and decision rules.

Schreier (2012) recommends that for a quantitative content analysis that is designed to test a hypothesis, the researcher should use different materials to conduct the pilot test (p. 148).

However, I utilized the same material. When I chose the books for the study, I limited the sample to three books, that upon initial review looked as if they could be adopted as a textbook for the course. Fortunately, Schreier explains it is acceptable for qualitative content analysis looking for a deeper understanding for the material to use the same texts during the trial test and the full study. Schreier also warns against using material in the trial testing that is different from the material utilized in the main coding. For these reasons, reflecting on the decision to use the same material in the initial coding and the final coding does not appear to be a significant limitation of the study, but instead allowed for a more thorough analysis.

Another limitation of my initial coding review was the limited variability (Schreier, 2012, p. 149). The first review should not have been limited to only a few chapters from each text. The review should have included the full coding framework. Upon final review of the results, I would not have been able to randomly choose a book from the sample that would have provided the widest framework coverage, therefore the decision to review each text in its entirety during the second and third reviews was the most appropriate approach.

Chapter 4 Preface to Human Factors for the Undergraduate Aviation Student

This project to write a Human Factors textbook for Aviation Undergraduate Students had two catalysts. Years ago, when I first started teaching, I was astonished by the lack of course resources provided to a new teacher. My first semester I was developing a course as I was teaching it, the same thing happened each time I was assigned a new course. I wanted to develop what I referred to as "survivor's guides" for teachers assigned new courses. Years later, I experienced a situation where a course assessed a programmatic outcome, but every instructor who taught the class had a different meaning of the outcome and how it was assessed. All teachers enjoy academic freedom to a certain extent; however, program assessment requires a level of transparency and curricular alignment across courses and sections.

This book seeks to minimize the divide between academic freedom and a prescriptive curriculum. The curriculum includes objectives and the tasks necessary to assess those objectives. Since the curriculum is developed around reading materials, the text also includes pedagogical aids to aid students in the learning process. The underlying educational philosophy of this text is constructivism, an educational approach with multiple interpretations that emphasizes the teacher's role as a guide and the development of reasoning and judgment by stimulating students' intrinsic motivation and utilizing authentic assessment to evaluate learning (see Altun & Buyukduman, 2007; Cotterill, 2015; Dewey, 1938, Kant, 1899/2003, Piaget, 1969; Roksa et al., 2017; Vygotsky, 1978). Any teachers using this book should follow the prescriptive curriculum as far as they want and adjust where necessary.

Objectives Development

Two approaches were used to review the learning objectives and learning activities for alignment. Most of the activities included in this text are activities I have already been using in

class; therefore, the alignment check was done retroactively. However, it is best to use these methods to design the course and choose activities. Unfortunately, teachers often develop a course with limited attention to alignment, something Biggs et al. (2022) and Anderson and Krathwohl (2001) are aware which is why they provide examples in their books of checking for misalignment after the course is designed.

According to Eisner (1994), behavioral or performance objectives require the behavior and the content to be defined (p. 109). Anderson and Krathwohl (2001) believe the term knowledge should be substituted for content and provides two reasons. The first reason is that "subject matter content is 'historically shared knowledge' that is arrived at through a currently shared consensus within a discipline and is subject to change over time…" (p. 13). The second reason is "to differentiate the subject matter content of an academic discipline from the materials in which the content is embedded…" (Anderson & Krathwohl, 2001, p. 13). Anderson and Krathwohl (2001) also substitutes the word behavior with cognitive process to minimize confusion with "behaviorism". For that reason, the term objective will be used to refer to learning expectations that have defined what students are expected to do, what they are expected to demonstrate knowledge of, and how it will be assessed.

Objectives were identified (shown in Table 4-1) based on the Aviation Accreditation Board International (AABI) outcomes, International Standards for Technology Education (ISTE) Standards, and National Association of Colleges and Educators (NACE) Career Competencies. I chose to keep the AABI wording for most of the objectives since those outcomes are specific to aviation and in many cases were more specific than NACE or ISTE. One exception was ISTE has a standard for asynchronous collaboration, since it would have been detrimental to include this objective with teamwork a separate objective was created. Another exception was NACE

provides a more detailed explanation of lifelong learning than AABI, therefore the first part of the NACE Career Competency for Career and Self-development was kept, the last part referred entirely to career development which is beyond the scope of a human factors course and was thus eliminated. Ultimately, I decided against including the AABI outcome "assess contemporary issues" since it would be assessed in the same manner as evaluating aviation safety and human factors.

Biggs et al., (2022) describes three elements for aligning objectives to assessment; intended learning outcomes, teaching/learning tasks, and assessment tasks. One change I made to this terminology is scaffolding/formative assignments shown in the Table 4-1. I chose to make this distinction to better show alignment since students will practice the objective before assessment. The grading rubrics for the teaching/learning activities have some of the same content areas and Criteria for Success as the scaffolding/formative tasks and assessment tasks, however the rubrics for the scaffolding/formative tasks are similar to the rubrics used for assessment. However, only the evaluation papers include the objectives rubric to support the assessment completed for the Major Project.

Table 4-1
Objectives alignment to tasks

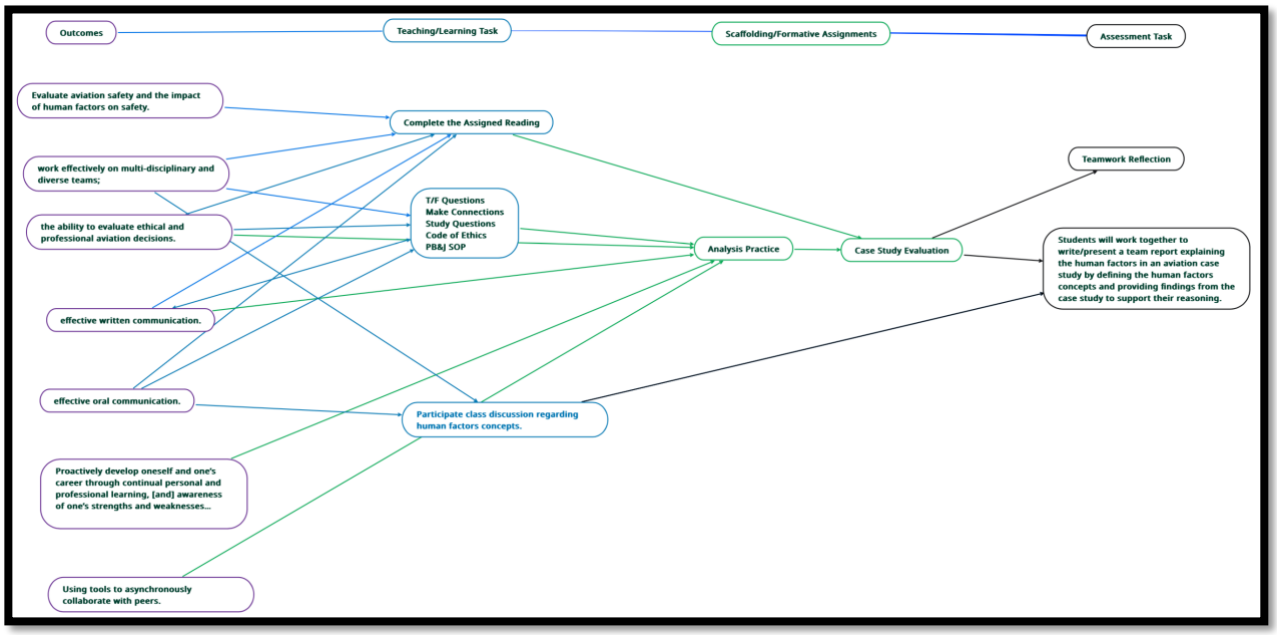
Objective	Teaching/ Learning Task(s)	Formative/ Scaffolding Task(s)	Summative/ Assessment Task(s)
Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses…		Analysis Practice Case Study Evaluation	Major Project
communicate effectively, using written communication skills;		Analysis Practice Case Study Evaluation	Major Project

communicate effectively, using oral communication skills;	In-Class Discussions		Major Project
make professional and ethical decisions	Reading T/F Questions Make Connections Study Questions Code of Ethics In-Class Discussions	Analysis Practice Case Study Evaluation	Major Project
work effectively on multi-disciplinary and diverse teams;	Reading In-Class Discussion	Case Study Evaluation	Major Project Teamwork Assessment
use tools to asynchronously collaborate with peers.		Case Study Evaluation	Major Project
Evaluate aviation safety and the impact of human factors on safety. - Aviation Physiology - Human Behavior - Error - Communication - Team Building - Leadership - Situation Awareness - Crew Resource Management - Decision Making	Readings T/F Questions Make Connections Study Questions In-Class Discussions PB&J SOP	Analysis Practice Case Study Evaluation	Major Project

As can be seen from the table, tasks are used for multiple objectives, which according to Tyler (2013) is appropriate. To ensure alignment between the multiple objectives, I mapped the tasks to the objectives, see Figure 4-1. This allowed me to incorporate all the outcomes into a coherent objective for the Major Project.

Figure 4-1

Objectives and Task alignment based on Biggs et al. (2022).



Learning and Assessment Tasks

The assessment task for all objectives is a final case study evaluation. This project can be tailored to individual course needs by having students complete the human factors evaluation as an individual or in a team. Keep in mind a team project would need to consist of students from multiple disciplines to meet the AABI teamwork outcome (G. Avendano & J. Merkt personal communication, February 2024). Students may submit the evaluation as a paper or present the information depending on the need to assess oral or written communication.

The example in Table 4-2- shows the rubric content area for "Evaluate aviation safety and the impact of human factors on safety." 70% of students should earn meets expectations (4/5).

Table 4-2
Evaluate aviation safety and the impact of human factors on safety assessment rubric.

Objectives	Exceeds Expectations	Meets Expectations	Developing	Basic	Unsatisfactory
Evaluate aviation safety and the impact of human factors on safety. This is a holistic evaluation of the content areas, Key Terms Evidence, Case Study Evidence, and Impact on Safety.	Students will earn Exceeds Expectations if the evaluation shows the connections between the factors (the factors aren't analyzed as discrete facts).	Students will earn Meets Expectations if the evaluation of the human factors impact on safety in the case study must be supported by strong evidence from the reading and case study that shows a deep understanding of the concepts.	Students will earn Developing if their evaluation of the human factors impact on safety in the case study was supported by evidence from the reading and case study but did not show a deeper understanding of the concepts.	Students will earn Basic if their analysis shows a basic application of the material to the Case Study, such as identifying the correct number of terms but failing to define/explain them and/or how they impacted safety.	Students will earn Unsatisfactory if they fail to identify, define/explain, and/or cite the required number of key terms or if their focus is primarily on WHAT happened.

Alignment between Objectives, Learning Activities, and Assessment

The Revised Bloom's Taxonomy by Anderson and Krathwohl (2001) should be used to identify the objective's appropriate cognitive process and type of knowledge before implementation. But it can also be used retroactively to check for assessment misalignment. This taxonomy consists of a matrix, with the type of knowledge students are expected to exhibit, plotted against the cognitive process they are expected to utilize. The knowledge dimension is

designated by letters, A-D. Factual knowledge corresponds to the letter "A" and refers to discreet facts. Conceptual knowledge (B) "includes knowledge of categories and classifications and the relationships between and among them" (Anderson & Krathwohl, 2001, p. 48). Procedural knowledge (C) is the knowledge of processes or steps of how to do something. The last position, D is for Metacognitive knowledge which refers to knowledge about cognition.

Table 4-3

Anderson and Krathwohl (2001) Revised

Bloom's Taxonomy

Knowledge Dimension	Cognitive Processes
A. Factual Knowledge	1. Remember
B. Conceptual Knowledge	2. Understand
C. Procedural Knowledge	3. Apply
D. Metacognitive Knowledge	4. Analyze
	5. Evaluate
	6. Create

Across the top of the matrix there are six cognitive processes. Remembering is identified as number 1 and emphasizes retention, whereas positions 2-6 focus on knowledge transfer (Anderson & Krathwohl, 2001, p. 64). Positions 2-6 are held by "Understand", "Apply", "Analyze", "Evaluate", and "Create" respectively. shows the Knowledge Dimension and Cognitive Processes. In the following tables, only the scaffolding/formative and assessment tasks were mapped to each objective using the taxonomy since the learning tasks help set the stage for learning at the lower levels of the cognitive processes and therefore not directly tied to the objective.

Lifelong Learning

The NACE description of Career and Self-Development uses the verb "proactively develop" which insinuates a need to make a judgment regarding the current level of development and a developmental goal. Therefore, it would seem the tasks that require students to analyze their strengths and weaknesses should be at the "evaluate" level. Students will need to learn from previous assignment feedback (from the instructor and peers) to make improvements for future assignments. The last half of the NACE Career Outcome, "navigation of career opportunities, and networking to build relationships within and without one's organization" (NACE, n.d.-a, p. 10) was removed since it is not relevant to a human factors specific course. Students will use lifelong learning principles (metacognitive knowledge) for personal and professional self-assessment (evaluation) and development (D5).

Table 4-4

Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses…

	1	2	3	4	5	6
A						
B						
C						
D					Analysis Practice Case Study Evaluation Major Project	

Communication

The term "using" in the communication outcomes seem to insinuate that communication is at the "apply" level. However, according to Anderson and Krathwohl (2001) writing a paper or developing a presentation is at the "create" level (p. 212). Communication was identified as C6 (see Table 4-5) for the paper and presentation since effective communication requires understanding of how the elements of communication and the criteria for success relate to one another to plan effective communication. Anderson and Krathwohl (2001) say that knowledge of the Criteria for Success is conceptual knowledge, however I decided to identify procedural knowledge since the rubrics are more analytical and not holistic. Please note, even though students will use oral communication during the class discussions, it is not identified as "practicing" the objective since it is not the same type of oral communication students will be assessed on.

Table 4-5
communicate effectively, using written communication skills;

	1	2	3	4	5	6
A						
B						
C						Analysis Practice Case Study Evaluation Major Project
D						

Table 4-6
communicate effectively, using oral communication skills;

	1	2	3	4	5	6
A						
B						

C						Major Project
D						

Professional and Ethical Decision Making

The AABI outcome, make professional and ethical decisions, uses the verb "make" which would appropriately be placed in B3 since students would be applying conceptual knowledge of what makes an ethical or professional decision to the case study. However, by requiring students to make a judgment on if they would do the same thing as the flight crew moves it from "apply" to "evaluate" (B5) for the Analysis Practice, Case Study Evaluation, and Major Project submission. I chose to require students to make an evaluation for ethics and professionalism to match the objective of evaluating the impact of human factors on safety.

The Analysis Practice, Case Study Evaluation, and Major Project were included in C3 since those assignments also require students to apply academic integrity procedural rules by providing evidence to support their evaluation and attribution for that evidence.

Table 4-7
make professional and ethical decisions

	1	2	3	4	5	6
A						
B					Analysis Practice Case Study Evaluation Major Project	
C			Analysis Practice Case Study Evaluation Major Project			

D	

Teamwork

Teamwork is included in B2, D3, and B5. Conceptual knowledge was identified since the simple act of knowing what makes an effective team does not create an effective team. However, students are expected to apply those principles in their groups (if completing the major project as a group) which requires a continues self-assessment and adjustment to behavior if the team is not effective. Student will then evaluate their teamwork on the Teamwork Assessment Assignment. The Analysis Practice, Case Study Evaluation, and Major Project also require students to evaluate the teamwork in the accident case study.

Table 4-8

work effectively on multi-disciplinary and diverse teams;

	1	2	3	4	5	6
A						
B					Teamwork Assessment	
C					Analysis Practice Case Study Evaluation Major Project	
D			Analysis Practice Case Study Evaluation Major Project			

Global Collaborator

It became necessary to add a specific outcome to meet the ISTE standard of global collaborator. This addition meant new learning and assessment tasks had to be created. Students will only need factual knowledge of how to use the collaboration tools and then apply that

knowledge to provide feedback (A3). This was not placed in evaluate since students are not evaluating their use of the tools but using the tool to evaluate. This objective is closely linked to lifelong learning since students are expected to use this collaboration in their revision process.

Table 4-9
Students use tools to asynchronously collaborate with peers.

	1	2	3	4	5	6
A			Case Study Evaluation Major Project			
B						
C						
D						

Evaluate Human Factors

B5 was chosen for the ability to evaluate human factors and their impact on aviation safety since the AABI core outcome specifically uses the term evaluate (E. Shappee, personal communication, 2024). To conduct an evaluation students would need to know how the concepts are related to one another and the case study. This evaluation goes beyond analyze since students must make a final judgment to explain the impact the human factors had on safety.

Table 4-10
the ability to evaluate human factors and their impact on aviation safety.

	1	2	3	4	5	6
A						
B					Analysis Practice Case Study Evaluation Major Project	
C						
D						

The Major Project assessment task will assess human factors and ethics and professionalism regardless of whether students complete the activity as a group or as individual or if it is completed as a paper or presentation. Lifelong learning (metacognitive knowledge) will be applied since students will complete scaffolding/formative assignments to receive feedback for improvement.

Table 4-11

Students will work together to write/present a team report evaluating the impact human factors had on safety in an aviation case study by defining the human factors concepts and providing findings from the case study to support their reasoning.

	1	2	3	4	5	6
A			Asynchronous Collaboration		Ethics and Professionalism	
B					Human Factors Teamwork	
C					Teamwork Ethics and Professionalism	Written Communication Oral Communication
D			Ethics and Professionalism Teamwork		Lifelong Learning	

This curriculum is designed to address seven objectives; lifelong learning, written and oral communication, professional and ethical decision making, teamwork, collaboration, and evaluation of human factors impact on safety. The major project assignment has been designed to assess all of the objectives to simplify assessment requirements for the educator. However, if the instructor needs to assess written and oral communication, they will need to assign students both the paper and the presentation. Using one task to assess multiple objectives makes objective alignment even more paramount between the scaffolding/formative tasks and the assessment task.

Constructive Assignment Design

Constructivism is an educational approach with multiple interpretations that emphasizes the development of reasoning and judgment by stimulating students' intrinsic motivation and utilizing authentic assessment to evaluate learning. Within constructivism, more emphasis is placed on the skills used and developed during the learning process than the immediate recall of facts. Constructivism requires students to take an active role in the learning process (Grabinger & Dunlap, 1995; Roksa et al., 2017, p. 287) and take responsibility for their learning (Lee & Hannafin, 2016). To that end, students must be prepared for class and a lecture should not be the student's first exposure to the material.

The learning tasks, scaffolding/formative tasks, and assessment tasks utilized Ralph Tyler (2013) five principles for selecting learning experiences:

1. For students to achieve the objectives they must be provided the chance to develop those skills in the same manner they will be evaluated and will be expected to use those skills in the real world.
2. Students must derive "satisfaction" from the experience (p. 66).
3. Students must be capable of accomplishing the objective of the learning experience.
4. More than one experience can support the same objective(s).
5. One learning experience can have multiple objectives.

Activities supporting student preparation for class focus more on principles #2-4. These learning tasks do not directly support a learning objective and are more academic than authentic to meet principle #1 and #5 but students can derive satisfaction from their completion since they will be prepared to participate in class (principle #5). The assignments I have included may be

used to teach students at different levels of development, therefore multiple activities were included to satisfy principles #3 and #4.

I have paid close attention to #1-3 and #5 to design the scaffolding/formative and assessment tasks. It is up to each individual instructor to remember principle #4 and determine if another task is better suited to their assessment needs. The best way to use this book as a prescriptive constructivist curriculum is to require students to 1) complete an assignment prior to covering the material in class, 2) complete the discussion questions before participating in class discussions, and 3) finish the module with an activity designed to use higher cognitive processes.

Student Preparation for Class. Carney et al. (2010) studied methods of increasing student completion of course readings. They found that the students that completed a learning log before class were motivated to do the readings than the students that completed the same questions in class. These students also reported a higher perception of their abilities to contribute to class discussions.

For lower division courses (freshman/sophomore) the understanding assignments (5-4-3-2-1, learning logs, true/false, or study questions) are sufficient first exposure to the material. The instructor can choose which assignment students complete or they can allow students to choose. Allowing freshmen/sophomore students to choose which of the understanding assignments to complete can serve as an intrinsic motivator or at the very least decrease frustration by giving them the autonomy to choose.

The 5-4-3-2-1 assignment provides students opportunity to explore multiple metacognitive strategies, such as defining key terms, creating practice test questions, explaining concepts they learned and concepts they found interesting, and ask the instructor any remaining

questions they may have. When grading this activity instructors must provide an explanation for the question students ask if the question is clear and relates to the reading.

The application assignments (such as the Case Study Timeline, Code of Ethics, and Peanut Butter and Jelly Standard Operating Procedure) can be completed at the end of the week for freshman/sophomore courses. Students can then complete the analysis practice assignments for multiple modules at a time (i.e. Introduction to Human Factors, Ethics and Professionalism, and Managing Unsafe Acts). Students in lower division courses most likely do not have the experience to complete the evaluation assignments and the written and oral communication requirements. At the lower levels instructors typically do not assess program objectives, only introduce or practice. However, lifelong learning and asynchronous collaboration could be assessed at the lower levels.

Junior/Senior students should complete the application assignments (such as the Case Study Timeline, Code of Ethics, and Peanut Butter and Jelly Standard Operating Procedure) for first exposure, then complete the discussion assignments, and finish the module with the analysis practice assignments.

Social Constructivism. All levels of students should complete the Discussion Questions and participate in a discussion. Kintsch (2009) argues that students will learn deeper if they read to participate in a class discussion versus reading to pass a test (p. 225). According to Golding (2011), class discussions can lay anywhere along a continuum, from student directed to instructor directed. These discussions can guide students to the "correct" answer or lead them through the process of discovering what the knowledge means to them. Less guidance during the discussion can lead to a distinct lack of progress in the discussion (Golding, 2011). You will notice the discussion questions I have included vary in their level of "right vs wrong". These

questions should provide students with an opportunity to explore the concepts and not just repeat the reading, but their exploration must be based on reality, or they may retain the incorrect information.

Major Project Case Study Evaluation. Constructivism also requires authentic assessment of student learning (Altun & Buyukduman, 2007; Bostock, 1998; Cotterill, 2015; Krahenbuhl, 2016). To be authentic, assignments must:

1. The tasks used to assess what students know and can do need to reflect the tasks they will encounter in the world outside of schools, not merely those limited to the schools themselves.
2. The tasks used to assess students should reveal how students go about solving a problem, not only the solutions they formulated.
3. Assessment tasks should reflect the values of the intellectual community from which the tasks are derived.
4. Assessment tasks need not be limited to solo performance. Many of the most important tasks we undertake require group efforts.
5. New assessment tasks should make possible more than one acceptable solution to a problem and more than one acceptable answer to a question.
6. Assessment tasks should have curricular relevance, but not be limited to the curriculum taught.
7. Assessment tasks should require students to display a sensitivity to configuration or wholes, not simply to discrete elements.
8. Assessment tasks should permit the student to select a form of representation he or she chooses to use to display what has been learned. (Eisner 1991, pp. 203-209)

The evaluation assignments and Major Project meet Eisner's requirements for authentic assessment. Since the Major Project assignment is used to assess written or oral communication the final product must be represented in written or oral form, however students should be allowed to choose their case study.

Scaffolding/Formative Assignments. Bruner (1960), Dewey (1938), Tyler (2013), and Vygotsky (1978) all had principles that referred to the need to design learning tasks so that students built on previous knowledge. It should be noted at this time that these concepts are not limited to one course but can be used to develop any size of curriculum, such as one module, one course, or an entire program. However, assignments within one course that are designed following these concepts can be referred to as a scaffolding or formative assignment. Bruner (1960) developed the spiral curriculum where students would revisit basic concepts in increasing difficulty. Dewey's (1938) concept of continuity maintained that learners build on previous knowledge by making connections between topics.

Tyler (2013) stated that one activity is not sufficient for students to be introduced to, practice, and be assessed on learning objectives (Tyler, 2013, p. 83). He maintained there are three criteria for organizing learning experiences: continuity, sequence, and integration (Tyler, 2013, p. 84). Integration focuses on ensuring students practice learning objectives in multiple subjects (such as written communication) and not just in one specialized course (such as a writing course). That focus is beyond the scope of this one book, therefore the assignments included here utilize continuity and sequence for organization. Continuity refers to the concept that students should have multiple opportunities to practice a given objective and sequence means those opportunities should allow for the progressive development toward achieving the objective.

Dewey (1938), Tyler (2013), and Vygotsky (1978) agreed that learning tasks should not designed at a student's current level of development but should instead allow continuous growth. To that end Vygotsky's Zone of Proximal Development was used to plan the included activities. Vygotsky's (1978) Zone of Proximal Development (ZPD) is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86). Assigning activities within a student's Zone of Proximal development with sequentially increasing difficulty or complexity allows the students to tackle a large project in small chunks. This type of assignment is referred to as scaffolding or formative assignments.

The concept for scaffolding/formative assignments always makes me think of the children's joke "What is the best way to eat an elephant?" One bite at a time. Scaffolding/formative assignments help students build or form a framework within which to work. This can result in more work for students and instructors but can result in better products and decreased student frustration since they have been provided guidance on what they are expected to do and have received feedback throughout the process. Completing scaffolding assignments is also akin to Vygotsky's (1978) example of deriving satisfaction from running a race in the sense students are "conditioning" themselves similar to how athletes prepare for marathons, half-marathons, or 5-K Runs. This may allow students to receive more satisfaction from writing the final paper because of the decreased frustration due to the provided feedback and guidance.

Allowing students to practice the learning in the same context they would be expected to demonstrate that knowledge in the real world, requires students to do as the experts do (Bruner,

1960, p. 30). Since students are completing the evaluation as a human factors investigation, they must do as the experts do and provide evidence to support their analysis and evaluation. Unfortunately, in the academic setting students do not have access to an accident investigation scene or a laboratory to conduct tests or witnesses to interview therefore, their evidence is limited to the case study report and the reading.

If an instructor chooses not to assign the scaffolding/formative tasks for the Major Project paper or presentation, they should provide further instructions and guidance beyond the final overview. Omitting the scaffolding assignments is not recommended since the analysis practice assignment supports the evaluation paper, the overview for the latter assignment does not include all of the information contained in the scaffolding assignment. The same goes for the support the evaluation paper provides for the Major Project paper or presentation. Instructors can minimize the time they spend grading the scaffolding assignments by leveraging peer feedback in the revision process. Feedback is vital when students are operating in the Zone of Proximal Development, therefore simply grading the scaffolding assignments on completion and not providing feedback would hinder the learning process and make scaffolding assignments more "busy work" and not supportive of the final product.

The instructor could also use the evaluation papers in lieu of a traditional test. This better aligns with constructivism by utilizing authentic assessment and minimizes the instructor's upfront work of developing test questions. However, teachers would be spending the same amount of time over the course of the semester grading papers. Another trade off would be for the students to complete the papers as a group, this minimizes the number of papers the instructor has to grade but also decreases the content each individual students covers. I argue if students cover a smaller portion of the material in the evaluation papers, they will be covering it

at a deeper level than a traditional test. If completing the papers as a group, it becomes even more imperative for students to complete the understanding and application assignments as an individual to ensure they have reviewed all the material.

Pedagogical Aids

Studies have found that the most helpful aids or the ones students are most likely to use are boldfaced terms (Gurung, 2003; Marek et al., 1999; Weiten, 1996;1999), running or chapter glossaries (Weiten, 1996;1999; Marek et al., 1999), chapter summaries, self-tests (Weiten, 1996; 1999), italicized terms, and practice questions (Gurung, 2003). For this book, I chose to use italicized key terms. Italicized key terms were identified as helpful (Gurung, 2003) and APA (American Psychological Association) formatting calls for italicized key terms when they are explained or defined (APA, 2022). Since students will be asked to italicize their key terms in select assignments, it seemed appropriate to also italicize them in the reading so that students are exposed to that formatting choice. Key terms are also listed at the end of the reading with page numbers; however, I chose not to include a glossary since the terms are defined when they are italicized in the reading per APA requirements. Also including a running glossary would have complicated each page which already had other embedded with information.

One pedagogical aid that Weiten (1996; 1999) found that students were likely to pay attention to was self-tests, and Gurung (2003) identified practice questions as one of the most helpful aids. This text has two versions of practice questions; true/false questions embedded in the reading and study questions at the end of reading. The true/false questions are embedded in purple boxes throughout the reading to serve as a self-test for students to check how well they are understanding the material. These questions cover some (not all) significant points. Students should study what makes these statements true or false, not just that they are true or false. I

recommend the students should rewrite the false statements as correct statements in their notes. Each module has a different number of true/false questions. Since more points are assigned for false statements rewritten as true statements than just identifying if a statement is true, it would be exceptionally difficult to make each assignment worth a set number of points. If it is important for the instructor to make each assignment worth the same number of points, you should adjust the Criteria for Success to meet your needs.

The Study Questions assignments include different question types such as fill in the blank and short answer (only requiring 1-2 sentences to answer). You will also notice this assignment provides grades per question and not a set number of points for the assignments. If it is necessary for the instructor to have a set number of points you can tell students to complete a specified number of questions or specific questions. This change would mean adjusting the tasks section of the assignment overview.

Since both True/False and Study question assignments include questions that are published, the answers may appear on the internet or be shared from course to course, therefore if the instructor requires students to complete these as assignments, they should be lower stakes to discourage cheating and not reward cheating if it occurs but also extrinsically motivate students to complete them.

Other pedagogical aids I have included are designed to support students in deeper understanding of concepts by making connections and completing a practice analysis of the Colgan 3407 National Transportation Safety Board's report. According to Bruner's (1960) spiral curriculum and Dewey's (1938) concept of continuity, learners build on previous knowledge by making connections. There are "make connections" activities in green boxes throughout the reading. Student notes should include why they believe those concepts are connected. Students

also may be unfamiliar and therefore uncomfortable completing a case study analysis. In orange boxes at the end of the reading students have the opportunity to practice conducting an analysis based on the NTSB's report on Colgan 3407. The boxes will provide an excerpt from the case study and then prompt students to identify human factors related to the module concepts.

According to Gurung (2004) pedagogical aids can negatively impact student learning if they are not used by students to test their understanding and vary their study habits to improve learning. Students should be encouraged to use pedagogical aids for reflection and should receive feedback. Instructions for the True/False, Making Connections, and Practice Analysis tasks are also included at the end of the module as Practice Activities, if the instructor chooses to assign them.

Assignment Overviews

The assignment overviews for the included activities follow the TILT Higher Ed Guidelines for Transparent assignments. These guidelines include providing students the purpose of the assignment, tasks, and the criteria for success (Wilkhelmes, 2019). The TILT Transparent Assignments are not considered prescriptive, each instructor is encouraged to provide this information in the format they find most appropriate, which may be written, oral or both.

The purpose section provides an overview of what the assignment seeks to accomplish and the learning objectives (identified in the previous section). Tasks are numbered to designate the tasks that should be completed in order; some tasks can be completed in a different order without altering the final submission. However, tasks should not be skipped. The Criteria for Success includes an overview of the grading requirements and a rubric (where appropriate). Before completing the activity, students should complete the assigned reading and familiarize themselves with all aspects of the assignment overview before starting on the activity. The

assignment overviews included embedded links to external sources to help students retrieve further guidance, such as a link to the APA website for help with citations or other sources students need to review to be successful on the assignment.

The Criteria for Success includes information on how students will be graded. Some assignments have a point break down and others include rubrics. The rubrics do not include point values so that instructors can weigh the content areas how they see fit. According to Panadero and Jonsson (2013; 2020), rubrics can be holistic (all criteria are considered as one), analytical (all criteria are considered separately), generic (applicable to different tasks or contexts), or task specific. The rubrics included in this curriculum are varied. For instance, the 5-4-3-2-1 assignment rubrics are task specific and analytical. Biggs et al. (2022) argues for a holistic approach to rubric development. They use the example of someone performing surgery, the cuts may be perfect and other elements done as expected, however if they cut off the wrong body part the task should be a failure. The evaluation papers and major project rubrics have analytical content areas that are then holistically considered for the relevant assessment content areas. I have attempted to make content areas as generic as possible so that students' understanding of those content areas transfers to other activities, but at times task specific content areas were necessary for clarity. Some rubrics have blacked out performance criteria. This is not a mistake and means the performance criteria is not applicable to that content area.

Major Project (Paper)

Final Case Study Evaluation

Purpose

This is an academic paper where you will assume you are investigating an aviation accident and preparing a written report for an audience of industry professionals in Human Factors, Aviation, and Safety. These professionals are not considered "experts" but are knowledgeable in their field (and only their field). Your report must first clearly articulate the human factors present in the case study and then evaluate how those factors impacted safety.

Objectives

Through this assignment you will be **assessed** on the objectives to 1) Evaluate aviation safety and the impact of human factors on safety, 2) communicate effectively, using written communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses….You may complete this assignment in a team therefore you may also be **assessed** on the objective to work effectively on multi-disciplinary and diverse teams.

Tasks

1. Review the module reading and the assigned case study.
2. Complete an evaluation of the human factors in the assigned case study.
    a. You are required to include at least *three specific key terms each* for Teamwork, Ethics, and Professionalism. You can cover any other human factors you wish.
    b. Review the Case Study Evaluation Paper assignment overviews for prompts.
3. Add an introduction with a thesis statement and conclusion.

4. Submit the evaluation paper with evidence of draft revisions.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students should not have the same analysis and evaluation as a peer or another group.
- Assignments that do not meet the word count requirement (2,500-3,000 words) will be assigned a score of zero (0) (if you exceed the maximum word count, please contact the instructor for guidance).
- Follow current APA guidelines.
- Include APA headings for each prompt.
- Include an introduction with a thesis statement and conclusion. The topic sentence of each paragraph must support the thesis statement.
- You must include accurate evidence to support the analysis. Evidence must be correctly cited and referenced.
- Specific human factors key terms must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and cited correctly.
- Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis and evaluation for your audience.
- The paper cannot include more than 2 direct quotes 5-40 words. If you choose to use a direct quote of more than 40 words, you are limited to one direct quote.

	Yes	Developing	No
Is the APA Title Page Formatted correctly?	No errors in the following: - APA Formatting - Formatting matches the body of the paper - Title Page includes the required information.	Minor (1-2) mistakes in the following: - APA Formatting - Formatting matches the body of the paper - Title Page includes the required information	
Are the APA In-text Citations and End of Text References formatted correctly?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Does the paper have an Introduction and Conclusion?	The paper includes an introduction that previews what the paper will cover with a thesis statement and a conclusion which summarizes the major points.	Introduction OR Conclusion does not adequately preview/summarize the paper.	
Is the paper organization logical and does it add to the understanding of the topic and assignment purpose?	Paper organization is logical and uses headings that correspond to the purpose of the assignment and supports the thesis statement.	Paper organization is logical but DOES NOT use headings that correspond to the purpose of the assignment.	
Are the Mechanics formatted correctly?	All of the following: - All acronyms are formatted according to APA requirements ex. Federal Aviation Administration (FAA).	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation Administration (FAA)).	

	- Paragraphs contain topic sentences that support the thesis statement. - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	- Some (1-2) paragraphs are missing topic sentences that support the thesis statement. - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included?	The required number of key terms/concepts were identified, defined/explained, and cited.	One of the following: - 75% of the required key terms/concepts were identified, defined/explained, and cited. - The required number of key terms/concepts were identified, defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the identification of the human factor key terms/concepts.	One of the following: - Cited findings from the case study are used incorrectly to support the identification of the human factor key terms/concepts. - Findings were interpreted incorrectly.	Cited findings from the case study are absent or the cited findings from the case study focus more on reporting what happened and not supporting the analysis.

		- The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	
Was the impact human factors has on aviation safety discussed and supported by evidence?	Cited facts were used to support the evaluation of how human factors generally impact safety.		Personal opinion and/or uncited facts were used to support the evaluation of how human factors generally impact safety.
Was the analysis and evaluation an original application of course concepts?	Evaluation used an appropriate number of direct quotes and focused on evaluating the Human Factors and not simply reporting the findings.		Too many direct quotes were used and/or the focus was on repeating the findings and not on conducting an analysis and evaluation.
Blacked out performance criteria means that criterion is not applicable to that content area			

Objectives:	Exceeds Expectations	Meets Expectations	Developing	Basic	Unsatisfactory
Evaluate aviation safety and the impact of human factors on safety. This is a holistic evaluation of the content areas, Key Terms Evidence, Case Study Evidence, and Impact on Safety.	Students will earn Exceeds Expectations if the evaluation shows the connections between the factors (the factors aren't analyzed as discrete facts).	Students will earn Meets Expectations if the evaluation of the human factors impact on safety in the case study must be supported by strong evidence from the reading and case study that shows a deep	Students will earn Developing if their evaluation of the human factors impact on safety in the case study was supported by evidence from the reading and case study but did not show a deeper	Students will earn Basic if their analysis shows a basic application of the material to the Case Study, such as identifying the correct number of terms but failing to define/explain them and/or how they impacted safety.	Students will earn Unsatisfactory if they fail to identify, define/explain, and/or cite the required number of key terms or if their focus is primarily on WHAT happened.

		understanding of the concepts.	understanding of the concepts.		
communicate effectively, using written communication skills; This is a holistic evaluation of citations and references, introduction/conclusion, organization, mechanics, the evaluation of human factors.	Students will earn Exceeds Expectations if the evaluation demonstrates no errors in the conventions of academic writing and clearly articulates a deep understanding of human factors to the intended audience.	Students will earn Meets Expectations if the evaluation demonstrates minor (1-2) errors in the conventions of academic writing and clearly articulates a deep understanding of human factors for the intended.	Students will earn Developing if the evaluation demonstrates minor (1-2) errors in the conventions of academic writing, but at times the student's viewpoint was not clear or the student's viewpoint did not show awareness of the audience (the paper appears to be written for the instructor as the audience).	Students will earn Basic if the evaluation demonstrates multiple (3-4) errors in the conventions of academic writing and clearly articulates a deep understanding of human factors for the intended audience.	Students will earn Unsatisfactory if the evaluation demonstrates multiple (3-4) errors in the conventions of academic writing, and at times the student's viewpoint was not clear or the student's viewpoint did not show awareness of the audience (the paper appears to be written for the instructor as the audience).
use tools to asynchronously collaborate with peers	Students will earn Exceeds Expectations if they submit evidence they used acceptable technological asynchronous tools that provided immediate feedback and they utilized	The student will earn Meets Expectations if they submit evidence, they used acceptable technological asynchronous tools that provided immediate feedback and they utilized	The student will earn Developing if they submit evidence, they used technological tools to collaborate asynchronously that did not allow for the immediate viewing of updates	The student will earn Basic if they submit evidence, they did not use technology, but they did collaborate asynchronously (such as printing copies for review).	The student will earn Unsatisfactory if they did not use anything to collaborate asynchronously.

	that feedback in their submission. This does not include feedback from group members if completing the assignment as team.	that feedback in their submission (such as Office365 and Google Share Links).	(such as emailing files).		
Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses…	The student will earn Exceeds Expectations if they demonstrate considerable attention to detail with no mistakes in grading rubric content areas, makes improvements from instructor feedback and submits evidence of draft revisions based on feedback from someone outside the course with topic or writing expertise.	The student will earn Meets Expectations if they demonstrate considerable attention to detail with mistakes in one or two grading rubric content areas, makes improvements from instructor feedback, and submits evidence of draft revisions based on peer review or self-reflection.	The student will earn Developing if they make mistakes in multiple (3-4) rubric content areas but make improvements based on instructor feedback and submits evidence of draft revisions based on peer review or self-reflection	The student will earn Basic if they make improvements based on instructor feedback OR submits evidence of draft revisions based on peer review or self-reflection	The student will earn Unsatisfactory if they do not make necessary corrections from instructor feedback and do not submit evidence of draft revisions.

Major Project (Presentation)

Final Case Study Evaluation

Purpose

This is an academic presentation where you will assume you are investigating an aviation accident and preparing an oral report for an audience of industry professionals in Human Factors, Aviation, and Safety. These professionals are not considered "experts" but are knowledgeable in their field (and only their field). Your report must first clearly articulate the human factors present in the case study and then evaluate how those factors impacted safety.

Objectives

Through this assignment you will be **assessed** on the objectives to 1) Evaluate aviation safety and the impact of human factors on safety, 2) communicate effectively, using oral communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses….You may complete this assignment in a team therefore you may also be ASSESSED on the objective to work effectively on multi-disciplinary and diverse teams.

Tasks

1. Review the module reading and the assigned case study.
2. Complete an evaluation of the human factors in the assigned case study.
    a. You are required to include at least *three specific key terms each* for Teamwork, Ethics, and Professionalism. You can cover any other human factors you wish.
    b. Review the Case Study Evaluation Paper assignment overviews for prompts.
3. Add a Title Slide and References Slide.

4. Add slides for an introduction with a thesis statement and conclusion.
5. Submit the evaluation presentation with evidence of draft revisions (if applicable).

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students should not have the same analysis and evaluation as a peer or another group.
- Assignments that do not meet or exceed the time requirement (15-20 Minutes) will be assigned a score of zero (0).
- Follow current APA guidelines.
- Include slides for an introduction with a thesis statement and conclusion.
- Include slide titles to support the thesis statement.
- You must include accurate evidence to support the analysis. Evidence must be correctly cited and referenced.
- Specific human factors key terms must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and cited correctly.
- Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis and evaluation for your audience.
- The presentation cannot include more than 2 direct quotes 5-40 words. If you choose to use a direct quote of more than 40 words, you are limited to one direct quote.

	Yes	Developing	No
Is the APA Title Slide Formatted correctly?	No errors in the following: - Title Slide includes the required information for an APA Student Title Page. - Title slide is a legible font and font size.		Title slide is missing information or is not legible.
Are the APA In-text Citations and End of Text References formatted correctly and legible?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Does the presentation have an Introduction and Conclusion slide?	The presentation includes an introduction that previews what the presentation will cover with a thesis statement and a conclusion which summarizes the major points.	Introduction OR Conclusion does not adequately preview/summarize the presentation.	
Is the presentation organization logical and does it add to the understanding of the topic and assignment purpose?	Paper organization is logical and uses slide headings that correspond to the purpose of the assignment and support the thesis.	Presentation organization is logical but DOES NOT use headings that correspond to the purpose of the assignment.	
Did the student make consistent and meaningful eye contact with the audience?			
Was the student voice clear, use inflection, and easy to follow (i.e. not to fast)?			

Are the Mechanics (grammar, sentence structure, and spelling) formatted correctly? Bullet points are appropriate for a presentation, avoid full sentences.	All of the following: - All acronyms are formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included to support the analysis?	The required number of Human Factors key terms/concepts from the case study were identified, defined/explained sufficiently to demonstrate deep understanding of the course materials, and cited.	One of the following: - 75% of the required Human Factors key terms/concepts from the case study were identified, defined/explained sufficiently to demonstrate deep understanding of the course materials, and cited. - The required number of Human Factors key terms/concepts from the case study were identified, defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the	Cited findings from the case study are used incorrectly to support the identification of	Cited findings from the case study are absent or the cited findings from the case study

	identification of the human factor key terms/concepts.	the human factor key terms/concepts. Findings were interpreted incorrectly. The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	focus more on reporting what happened and not supporting the analysis.
Was the impact human factors has on aviation safety discussed and supported by evidence?	Cited facts were used to support the evaluation of how human factors generally impact safety.		Personal opinion and/or uncited facts were used to support the evaluation of how human factors generally impact safety.
Was the analysis and evaluation an original application of course concepts?	Evaluation used an appropriate number of direct quotes and focused on WHY and not WHAT (simply reporting the findings).		Too many direct quotes were used and/or the focus was on repeating the findings and not on conducting an analysis and evaluation.
Blacked out performance criteria means that criterion is not applicable to that content area.			

Objectives:	Exceeds Expectations	Meets Expectations	Developing	Basic	Unsatisfactory
Evaluate aviation safety and the impact of human factors on safety. This is a holistic evaluation of the content areas, Key Terms Evidence,	Students will earn Exceeds Expectations if the evaluation shows the connections between the factors (the factors aren't	Students will earn Meets Expectations if the evaluation of the human factors impact on safety in the case study is supported by strong evidence from the	Students will earn Developing if their evaluation of the human factors impact on safety in the case study supported by evidence from the	Students will earn Basic if their analysis shows a basic application of the material to the Case Study, such as identifying the correct number of	Students will earn Unsatisfactory if they fail to identify, define/explain, and/or cite any key terms or if their focus is primarily

Case Study Evidence, and Impact on Safety.	analyzed as discrete facts).	reading and case study that shows a deep understanding of the concepts.	reading and case study that did not show a deeper understanding of the concepts.	terms but failing to define/explain them and/or how they impacted safety.	on WHAT happened.
communicate effectively, using oral communication skills; This is a holistic evaluation of citations and references, introduction/conclusion, organization, mechanics, eye contact, voice, and the evaluation of human factors.	Students will earn Exceeds Expectations if the evaluation demonstrates no errors in the conventions of academic presenting and clearly articulates a deep understanding of human factors.	Students will earn Meet Expectations if the evaluation uses conventions of academic presenting to clearly articulate the student's viewpoint to the audience. The presentation is well organized with an appropriately descriptive introduction and conclusion, proper mechanics, and citations and references.	Students will earn Developing if the evaluation uses procedures of academic presenting but at times the student's viewpoint was not clear or the student's viewpoint did not show awareness of the audience (the presentation appears to be designed for the instructor as the audience).	Students will earn Basic if the evaluation was weak in one area of academic presenting but overall was able to articulate the student's viewpoint.	Students will earn Unsatisfactory if the evaluation was weak in more than one area of academic presenting or was not able to articulate the student's viewpoint.
engage in and recognize the need for life-long learning	Students will earn Exceeds Expectations if they demonstrate considerable attention to detail with no mistakes in grading rubric	Students will earn Meets Expectations if they demonstrate considerable attention to detail with mistakes in one or two grading rubric content	Student will earn Developing if they make mistakes in multiple (3-4) rubric content areas but make improvements based on previous	Student will earn Basic if they make improvements based on previous feedback or submits evidence of draft revisions.	Students will earn Unsatisfactory if they do not make necessary corrections from previous feedback and do not submit evidence of self-

	content areas, makes improvements from previous course work and submits evidence of draft revisions (based on self reflection or peer review).	areas, makes improvements from previous course work, and submits evidence of draft revisions.	feedback and submits evidence of draft revisions.		reflection and draft revisions.

Teamwork Assessment

Purpose

This is your opportunity to reflect on your teammates' contribution during the Major Project. This reflection does not impact your team members' grade and is only used for assessment purposes. If you have issues with a team member, you should communicate that with the instructor immediately.

Tasks

Rate your team members (excluding yourself) on a scale of 1-5 for the following questions.

	Never———Always				
Team Member did a fair share of the work.	1	2	3	4	5
Team Member was cooperative/did agreed upon task.	1	2	3	4	5
Team Member contributed to ideas/planning.	1	2	3	4	5
Team Member was available for communication.	1	2	3	4	5
Team Member was positive and helpful.	1	2	3	4	5
Team Member contributed to overall project success.	1	2	3	4	5

Criteria for Success

- Work collaboratively with your team members to complete the Major Project.
- 10% Major Project reduction for students who fail to complete the Teamwork Assessment.

Chapter 5 Module 1

Introduction to Human Factors

What is Human Factors?

In aviation, *human factors* is defined as a multi-disciplinary science that focuses on "optimizing human performance and reducing human error" (Federal Aviation Administration [FAA], 2004, p. 2). Human factors borrows from the behavioral and social sciences, engineering, and psychology and are not limited to analyzing the human but also the organization and how the system influences human performance.

Nontechnical Skills

Human error is referenced as a factor in up to 80 percent of aircraft accidents (FAA, 2004, p. 4; Wiegmann & Shappell, 2003, p. 2). These errors commonly have less to do with technical skills and more with nontechnical skills related to human factors, such as decision-making, communication, leadership and followership, and risk management (FAA, 2004, p. 4). Technical skills are beyond the scope of this book, but nontechnical skills will be our focus.

Crew Resource Management

The ability to work as a team is vital in the aviation industry, and human factors play a critical role in that ability. In the crew environment, teamwork is referred to as Crew Resource Management (CRM). However, CRM tenets apply to all aviation professionals. Currently, CRM is defined by the Federal Aviation Administration (2004) as "the effective use of all available resources: human resources, hardware, and information." (p. 2).

Cockpit Resource Management was introduced in the late '70s to mitigate errors related to crew performance (Helmreich, 1999, p. l; FAA, 2004, p. 5). The term Cockpit Resource Management was used initially since the focus was only on improving the performance of the pilots on the flight deck (Helmreich, 1999, p. 1). In the first generation, training programs focused on management training developed from non-aviation sources (Helmreich, 1999, p. 2). At first, Cockpit Resource Management utilized psychological testing and general concepts but failed to identify appropriate behavior on the flight deck (Helmreich, 1999, p. 2). Initially, these programs were not accepted by everyone, and some pilots thought it was an attempt to change their personalities, referring to it as a charm school (Helmreich, 1999, p. 2).

In the second generation of Cockpit Resource Management, the term 'crew' was substituted for "cockpit", and training began to reach outside the cockpit to teach proper utilization of all resources, which included air traffic control (ATC), flight attendants, mechanics, and dispatchers. *Crew Resource Management (CRM)* shifted focus from leadership and management to team-oriented concepts (Helmreich, 1999, p. 2). Unfortunately, training had limited aviation examples and relied on exercises from outside the industry (Helmreich, 1999, pp. 2-3). This generation of CRM was more widely accepted but still had dissenters (Helmreich, 1999, p. 3).

CRM training began to use more examples from the aviation industry and integrate technical and nontechnical skills in the third generation (Helmreich, 1999, p. 3). The third generation also saw the inclusion of an understanding of human factors (Helmreich, 1999, p. 3). In the second generation, pilots were taught to utilize all their resources: ATC, dispatchers, mechanics, and flight attendants. However, in the third generation, these employee groups were integrated into the training, and many pilots saw this as a dilution of CRM concepts (Helmreich, 1999, p. 3).

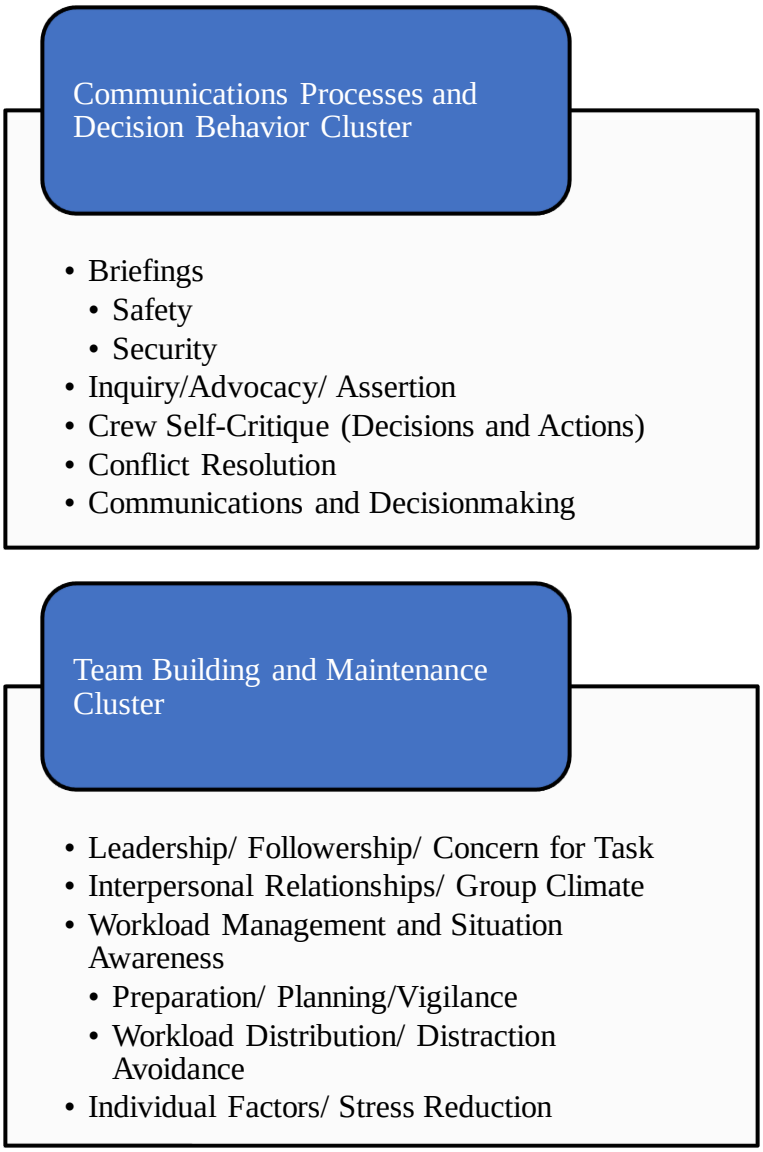
The fourth generation of CRM started with the FAAs introduction of the Advanced Qualification Program (AQP) in 1990 (Birnbach and Longridge 1993 as cited in Helmreich, 1999, p. 3). This program allows carriers to adapt CRM training to their needs but requires them to provide Line Oriented Flight Training (LOFT) along with CRM training (Helmreich, 1999, p. 3). This generation had the downside of CRM no longer being a stand-alone training program but being integrated with other aspects of training (Helmreich, 1999, pp. 3-4).

The fifth generation of CRM returned to its original roots of "error management" (Helmreich, 1999, p. 7). Human error cannot be wholly eliminated; therefore, training included the correct detection and recovery from errors (FAA, 2004, p. 16; Helmreich, 1999, p. 7). The fifth generation concentrated on teaching that errors cannot be eliminated entirely but also included the automation and leadership training from the third generation (Helmreich, 1999, p. 7).

Current FAA (2004) guidance for CRM includes two clusters of training curriculum topics, Communications Processes and Decision Behavior and Team Building and Maintenance. The *Communications Processes and Decision Behavior* cluster includes internal and external influences on interpersonal communications." (FAA, 2004, p. 10). The *Team Building and*

Maintenance cluster "includes interpersonal relationships and practices." (FAA, 2004, p. 10). The topics that make up each cluster are shown in Figure 4-2. Each topic will be covered in detail in future modules.

Figure 4-2
CRM Curriculum Topics (FAA, 2004)



Accident and Incident Investigations

The need to understand human factors was identified through investigations of critical accidents, such as the collision at Tenerife between two Boeing 737s. Accident investigation is a reactive process that aims to learn from the past. However, investigating can also be proactive if data is analyzed for trends to prevent future accidents and incidents (Wilson, 2023, p. 273). Investigations seek to understand an accident's underlying or root

T/F. Crew Resource Management was originally known as Cockpit Resource Management.

T/F. The FAA recommends 3 clusters of CRM Curriculum Topics for training.

cause and prevent further accidents. This course will focus on investigating human factors. The technical aspect will only be relevant as far as human factors are concerned. A human factors investigation seeks to understand the relationship between human performance and safety events (Bramble, 2019, p. 115). First, human factors and their hazards must be identified to understand the impact human factors have on safety.

In an investigation, two parts of an organization must be considered: the sharp end and the blunt end. (Dekker, 2014). The *sharp end* includes frontend employees who "are in direct contact with the safety-critical process" (Dekker, 2014, p. 39). If an investigation only focuses on employees, such as the flight crew, at the sharp end, it misses the chance to correct root organizational issues. The *blunt end* includes the organizations (such as the company or the regulatory organizations) behind that sharp end.

These two parts of the organization lead to different conditions that can lead to latent or active safety events. These conditions are sometimes referred to as errors or failures. There are two key differences between latent and active conditions: the time between the event and the negative consequences and the person's location within the organization (Reason, 1997, p. 11). Hidden or *latent conditions* may lie dormant within the organizational structure (Reason, 1997). These unsafe acts are, therefore, committed at a time typically far removed in time from the catastrophic event and by other than frontend employees. Frontend employees commit *active failures*, which generally have immediate effects. Latent and Active failures are explored further in Managing Unsafe Acts.

Views and Perspectives

As an investigator, you must also recognize your bias (Baker, 2010), which is why evidence is essential to investigations. To that end, investigators should be familiar with two

views and two perspectives. The two views on safety are the Old View and the New View. The *Old View* sees human error as the cause of safety events (Dekker, 2014). In an investigation, the Old View looks at what the human failed to do and what they should have done. It sees the system as inherently safe, only the human decreases safety. This safety view allows the organization to make an example out of a few "bad apples" (through disciplinary action), relieving itself of the responsibility to assess operations. In this view, all investigations are approached as an individual accident, relieving the organization of accountability.

In this course, you will utilize the *New View*, also called the system or organizational approach, to analyze the human factors in an accident or incident. This type of investigation looks at accidents as organizational accidents that may have led to individual accidents. The New View explores what people did and asks why they did what they did and why that action seemed appropriate at the time (Dekker, 2014). The New View requires an understanding of the context (organizational and situational) within which the person was operating. Remember that the New View is not about assigning individual blame but instead views human error as a symptom of the organizational culture (explored later in Managing Unsafe Acts) (Baker, 2010; Dekker, 2014). Safety events are often the result of a chain of causes and not a singular cause (Baker, 2010; Wilson, 2023). Analyzing the chain of events that led to an accident or incident is to look at the entire system (Baker, 2010). Because people work within the system, their actions are affected by the system (Wilson, 2023).

In addition to these two views, there are also two *perspectives* from which you can approach an analysis. You can look at the safety event from the outside looking in, or you can place yourself in the people's shoes within the event and look at it from the inside (Dekker, 2014). Part of acknowledging your bias includes knowing you have access to more information

than those in the event. This bias is referred to as a retrospective reaction, and it can prevent you from seeing the situation from the perspective of the people involved (Dekker, 2014). Knowing the outcome may also lead you to analyze counterfactuals or make judgments. Counterfactuals are characterized by statements like "should have" or "could have" and are inappropriate in your analysis. Judgment toward their actions is similarly wrong. These reactions to failure stem from your knowledge of what happened when you should be focusing on understanding why their actions made sense at the time. A timeline can be beneficial for understanding the sequence of events and decisions made (Dekker, 2014, p. 49). This timeline can help you see the time available to make decisions or understand the information available.

T/F. An organization has two parts to consider in an investigation: the "sharp end" and the "blunt end."

T/F. Employees at the "sharp end" contribute to latent conditions, and employees at the "blunt end" contribute to active conditions.

T/F. The two views on human error are the organizational approach and the operator approach.

T/F. The two perspectives on accident investigation are the "sharp end" or the "blunt end."

Timelines and Evidence

Investigators can only form a hypothesis after the appropriate information has been collected and analyzed. Your analysis should start with a timeline, a sequence of events (Dekker, 2014). This timeline should start with the active failure or the catastrophic event (Dekker, 2014). The sequence of events should not be limited to causes but should include findings, "all significant conditions and events, causal and non-causal, found in the investigation" (Wood and Sweginnis, 2006, p. 5). Your timeline should include the time in between the findings so you as the investigator are able to see not only what information was available when but also how much

time it was available before something else happened (Dekker, 2014). An example timeline of the Colgan 3407 accident is shown in Table 4-12, note the time stamps without findings that show how much time elapsed from the time the captain requested the gear be deployed to when it was locked in place. This timeline utilizes seconds as the time interval, but your timeline may use a different time interval.

Table 4-12
Timeline Example from Colgan 3407

Time Stamp	Participant	Finding
2216:04	Captain	Gear down request by captain
2216:05		
2216:06	First Officer	Gear handle selected
2216:07		Gear deployed
2216:08		
2216:09		Low-speed cue began to rise from the bottom of the airspeed display as the airspeed slowed.

In your investigation, your analysis comes down to the evidence you provide (Dekker, 2014). According to the Oxford Dictionary (n.d.), evidence is the "Grounds for belief; facts or observations adduced in support of a conclusion or statement; the available body of information indicating whether an opinion or proposition is true or valid." (Definition III.6.a.). The evidence to support your analysis requires deconstructing large or complex concepts into smaller component concepts. For your analysis in this class, you must identify the human factor, breaking it down into smaller conceptual chunks, and operationalize it by providing definitions/explanations from the reading and supporting evidence from your case study. Your

evidence will always be cited material from the reading and your case study. Your model will help guide your analysis, but models can be limited and are not predictive (Baker, 2010).

T/F. In an accident investigation, it is a sign of professionalism for an investigator to make assumptions without evidence to support their analysis.

T/F. Evidence supports the investigation so others can understand the final analysis.

Investigation Models

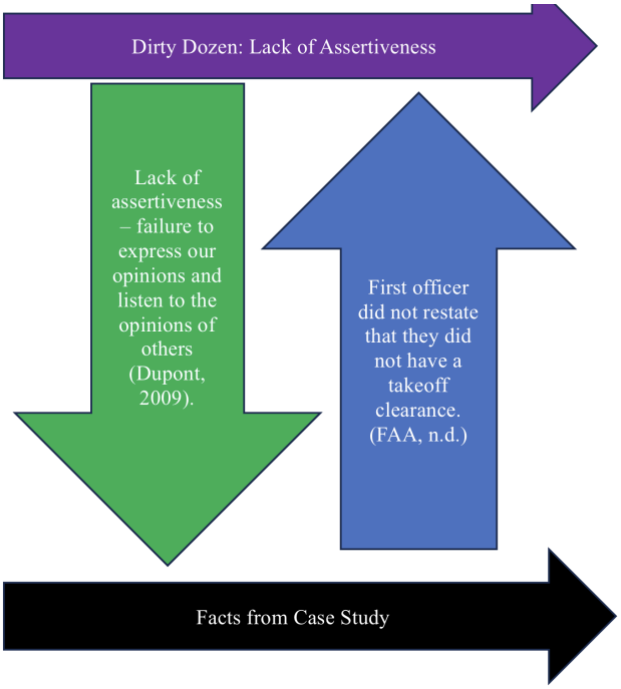
Models are often used to investigate aircraft accidents and incidents because they provide a simplified and systematic approach. Three models commonly used are the Dirty Dozen, SHELL, and Human Factors Analysis and Classification System (HFACS).

Dirty Dozen. Originally developed to analyze maintenance-related accidents, the *Dirty Dozen* includes twelve of the most common contributing factors to human error (Dupont, 2009). This model can be used to analyze any incident or accident, and the factors are not in particular order; you can start anywhere for the analysis.

- *Lack of Communication* – failing to maintain proper communication. This is characterized by failing to ask for or provide information when asked. It is also contributed to by poor communication methods and skills (Dupont, 2009).
- *Complacency* – characterized by an overconfidence in our skills, knowledge, or abilities.
- *Lack of Knowledge* – failure to obtain or retain the necessary knowledge to successfully complete our duties (Dupont, 2009).
- *Distraction* – anything that diverts attention from our task. These can be mental distractions or distractions in our environment, such as people or radio calls interrupting our tasks (Dupont, 2009).

- *Fatigue* – a mental and physical weariness that often goes undetected unless it is extreme (Dupont, 2009).
- *Lack of Teamwork* – failure to build and maintain team synergy. Crew members are not working together to accomplish their tasks (Dupont, 2009).
- *Lack of resources* – insufficient time or other resources to accomplish the task (Dupont, 2009).
- *Pressure* – We commonly feel pressured to accomplish tasks without the necessary resources or knowledge (Dupont, 2009). Operational Pitfalls are discussed in decision-making.
- *Lack of assertiveness* – failure to express our opinions and listen to the opinions of others (Dupont, 2009). Figure 4-4 shows an example of deconstructing the "Lack of Assertiveness" finding in the Tenerife accident involving KLM 4805 and Pan Am 1736. The definition of lack of assertiveness is shown by the green arrow (with a citation to show the efficacy of the evidence); this, coupled with the finding from the case study of the first officer's behavior, supports the analysis that lack of assertiveness was a factor in the accident.

Figure 4-3
Example of deconstructing a "lack of assertiveness" finding in the Tenerife collision.



- *Stress* – our response to physical and mental demands (stressors) (Dupont, 2009).
- *Lack of awareness* – failure to maintain a mental model of the elements in the environment (Dupont, 2009).
- *Norms* – also called the "culture" or "environment." This typically refers to unwritten rules and how things are typically done in the organization. Norms can have a positive or a negative impact on safety (Dupont, 2009).

T/F. The Dirty Dozen can only be used to analyze maintenance-related accidents and incidents.

T/F. When using the Dirty Dozen, it is imperative to analyze the preconditions in priority order.

SHELL. The *SHELL* model evaluates the interfaces between the human and four other system components (International Civil Aviation Organization [ICAO], 2012). The term interface describes the interaction between the central component (liveware) and the other components. The edge of each component is jagged to demonstrate the importance of adequately matching each interface. A mismatch between these components contributes to human error.

- *Liveware* – There are two human components in the SHELL model. Using the SHELL Model, the situation is analyzed from one person's perspective. That person is the center liveware. Humans are the least predictable component, but they can adapt to complications in the situation (ICAO, 2012). The second liveware in the model represents the other humans in the system, such as ATC, flight crew members, cabin crew members, maintenance personnel, dispatchers, and other coworkers. CRM is imperative for successful liveware-to-liveware interactions.
- *Hardware* – This component represents the airplane, maintenance hangar, office setting, or other physical work environment. Ergonomics is the scientific study of how humans interact with their physical environment, such as the size and shape of computer screens

and the comfort of the cockpit chair or office chair. People tend to adapt and overcome any negative factors when interfacing with the hardware of their environment (ICAO, 2012).

- *Software* – This component includes checklists, operations manuals, and job cards. How accessible and well-written these items are can positively or negatively impact how the human interfaces with them (ICAO, 2012).
- *Environment* – The environment component includes the physical environment (noise, temperature, and lighting), operational environment (organizational culture and operational context), and psychological and physiological environment (stress, fatigue, drugs, and alcohol) (ICAO, 2012).

T/F. The jagged edges of the SHELL model interfaces indicate that all the components must be carefully matched.

T/F. The environment is the least predictable component in the SHELL model.

T/F. The SHELL model focuses on analyzing how humans interact with their environment.

Make connections between the Dirty Dozen and the SHELL Models.

SHELL Model	Dirty Dozen Connection
Software Component	
Hardware Component	
Environment Component	
Liveware Components	
Liveware-Software Interface	
Liveware-Hardware Interface	
Liveware-Environment Interface	

Liveware-Liveware Interface

Human Factors Analysis Classification System (HFACS). The Swiss Cheese model was developed by James Reason to explain the multiple factors that lead to accidents (ICAO, 2012). Wiegmann and Shappell (2003) built on the Swiss Cheese model by defining specific types of failures and behaviors for each level and developed the *Human Factors Analysis and Classification System (HFACS).* The result was a framework that can be used to conduct an analysis, either reactively or proactively.

Unsafe Acts. When using the HFACS model, an analysis should always start with unsafe acts. *Unsafe acts* are the active failures that front-line employees typically commit. The specific types of errors and violations will be discussed in Managing Unsafe Acts.

Preconditions for Unsafe Acts. *Preconditions for Unsafe Acts* are latent failures and can precipitate active failures (Wiegmann & Shappell, 2003). This level is comprised of three preconditions: the environment, the condition of the operator, and personnel factors.

Environmental factors are both physical and technological (Wiegmann & Shappell, 2003). The physical environment includes the operational environment and ambient environment (temperature, noise, smells, and vibrations). The technological environment includes the workspace (cockpit, hangar, office) design, manual layout, and automation.

Human performance is impacted by adverse mental states such as stress, complacency, loss of situational awareness, workload, mental fatigue, and distractions (Wiegmann & Shappell, 2003). Adverse physiological states include illness, drugs or alcohol, and physical fatigue. Operator performance is also limited by physical or mental factors such as visual impairments, poor reaction time, and poor information processing.

Personnel factors are categorized as Crew Resource Management or Personal Readiness (Wiegmann & Shappell, 2003). Good CRM can successfully mitigate human error, but poor CRM (poor communication, poor resource management, poor team coordination) can contribute to unsafe acts. In Aviation Physiology, we will discuss the I'M SAFE checklist and personal readiness in depth. However, for this discussion, it is important to remember that we are responsible for ensuring we are ready to complete our duties to the best of our abilities. Fitness for duty requires maintaining good sleep and nutrition habits, avoiding drugs and alcohol that can inhibit our abilities, and maintaining our knowledge and decision-making skills.

Unsafe Supervision. *Unsafe Supervision* includes latent conditions related directly to how supervisors can contribute to accidents or incidents. Supervisors play a significant role in safety by setting the general culture and accepted behaviors within the work environment. If supervisors knowingly violate procedures, their subordinates may emulate that behavior. These procedural violations may also put others in compromising situations that decrease safety, such as violating rest requirements or duty day limitations or forcing subordinates to conduct unsafe operations (this will be discussed more when we discuss operational pitfalls). Supervisors are responsible for providing adequate guidance and supervision for subordinates to complete tasks. If supervisors fail to provide this guidance, people may create their own shortcuts or unknowingly complete the task incorrectly. While supervising subordinates, leaders must correct any mistakes or incorrect methods they may use.

Organizational Influences. *Organizational influences* include the latent conditions that the organization controls. Without adequate resources, employees cannot ensure safety. Resources may include staffing, training, sufficient funds, equipment, and space (Wiegmann & Shappell, 2003). The organizational climate includes the organization's policies and culture, such

as the norms discussed in the Dirty Dozen and the operational environment in the SHELL model. However, climate also includes the structure, such as the chain of command and how communication is accomplished. The organizational processes cover time pressures to complete operations, company goals, and safety programs.

Latent and Active Failures. The unsafe act itself is the only active failure/barrier within the Swiss Cheese and HFACS models; the other levels refer to latent failures (ICAO, 2012). Active failures occur relatively close in time to the event and generally within the control of front-line employees such as flight crew. Latent failures are removed in time from the event and are generally outside the control of flight line employees. These failures can be attributed to "corporate employees" who establish policies, maintenance personnel, or poor training. According to these models, accidents are caused by both latent and active failures together. Nevertheless, although rare, accidents can be the direct cause of one failure.

T/F. The HFACS causal categories were developed to identify active and latent failures.

T/F. The Human Factors Analysis and Classification System (HFACS) is based on the SHELL Model.

T/F. Poor teamwork is a failure at the Preconditions for Unsafe Acts HFACS level.

T/F. The poor allocation of resources is a failure at the Unsafe Supervision level of HFACS.

T/F. The goal of HFACS is not to attribute blame but to understand the causal factors that lead to an accident.

T/F. HFACS accident analysis uses the "systems" approach.

Make connections between HFACS and either the Dirty Dozen and/or the SHELL Model.

HFACS	Specific Category/Subcategory	Connection
Organizational Influences		
Unsafe Supervision		

Precondition for Unsafe Acts

Unsafe Acts

Practice your human factors analysis by identifying the relevant human factors in the following NTSB excerpt from the Colgan 3407 report.

According to the NTSB (2010),

> About 2216:09, the low-speed cue began to rise from the bottom of the airspeed display as the airspeed slowed. However, the flight crew made no remarks and took no actions that were consistent with the recognition of this cue. Also, because the autopilot altitude hold mode was engaged when the airplane leveled off at 2,300 feet, the autopilot continued to add nose-up pitch trim to maintain altitude as the airspeed slowed. During the time that the low-speed cue was in view, the airplane's pitch trim increased from 1° to 7° nose up, and the pitch attitude of the airplane increased from 3° to 9° nose up. Neither pilot remarked about the increasing pitch attitude, even though it was a cue indicating that airspeed was slowing. In addition, the numbers on the airplane's IAS [indicated airspeed] display changed from white to red as the airplane reached the calculated stick shaker activation speed. About 2216:27, the stick shaker activated at an airspeed of 131 knots, which was 13 knots higher than the Vref [reference speed] that the flight crew had set but 7 knots lower than the Vref icing speed. (p. 84)

The NTSB determined there was sufficient time for the crew to observe the airspeed indications. However, neither crew member reacted to the information (NTSB, 2010, p. 84). The investigators could not establish why the captain did not react to the airspeed indicator; however, the first officer's duties could have decreased her chances of seeing the indications. Based on the crew members' training, both had knowledge of the aircraft's ice protection system. The manufacturer's airplane flight manual warned of a stall potential if the ref speeds switch was in the increase position and airspeed was not increased (NTSB, 2010, p. 85).

The flight crew did not acknowledge the position of the ref switch either during their checklist or the alert on the engine display. "[If] the ref speeds switch had been turned to the off position after stick shaker activation, the shaker would have stopped. As a result, the NTSB concludes that the flight crew did not consider the position of the ref speeds switch when the stick shaker activated."

Model	What component(s) of each model is/are present?	Reading Evidence	Case study Evidence
Dirty Dozen			
SHELL			
HFACS			

In Conclusion

In conclusion, your investigation must look beyond the active failure and identify latent conditions that develop within the organization. Investigators must also look at the event from the viewpoint of those directly involved and avoid supposition language such as "should have."

You can learn viable lessons from incidents in the face of a limited number of accidents (Baker, 2010). Incidents are caused by the same human factors as accidents; therefore, they can provide information to prevent future accidents. Much can be gained from studying safety events that were handled successfully and did not result in an incident or accident. You can also analyze normal and abnormal operations (Dekker, 2014).

Key Term Index

KLM Flight 4805 and Pan Am 1736 at Tenerife HFACS Analysis

The Human Factors Analysis and Classification System (HFACS) can analyze any situation's active and latent factors but is primarily used to analyze accidents and incidents (Wiegman & Shappell, 2003). In the case of KLM Flight 4805 and Pan Am 1736, at least three subcategories contributed to the accident at Tenerife: the physical environment, Crew Resource Management (CRM), and organizational processes.

Organizational processes such as time pressures can be a latent factor in accidents (Wiegman & Shappell, 2003). At the time of this accident, KLM had a complicated duty day policy that allowed pilots to be fired for violating it (Stamford Krause, 2003). The captain was concerned about this policy and even called the company to see if the crew would violate the policy if there were any further delays.

The *physical environment* includes the operational environment and ambient environment (temperature, noise, smells, and vibrations) (Wiegman & Shappell, 2003). Adverse weather conditions added to the confusion by preventing the crews from adequately looking outside the aircraft. The takeoff clearance was a point of confusion between all three entities. The KLM crew knew it did not have clearance to take off, yet the captain continued the takeoff roll while the first officer communicated with Air Traffic Control (ATC). This behavior characterizes a violation. Both the controller and the KLM crew used non-standard phraseology, adding to the confusion.

Currently, *CRM* is defined by the Federal Aviation Administration (2004) as “the effective use of all available resources: human resources, hardware, and information” (p. 2). At Tenerife, there was a breakdown in CRM since not all resources were used effectively (Stamford Krause, 2003). The KLM Captain did not allow the first officer to successfully resolve the

discrepancy between his belief that they were already cleared for takeoff and the fact that they were not (Stamford Krause, 2003).

ATC is also a resource, and so is open radio communications, which allow everyone to hear radio calls so that everyone knows what is going on. The controller thought the KLM crew was ready for takeoff when the first officer used the non-standard phrase, “We are now at takeoff.” (Stamford Krause, 2003, p. 204). When the controller asked Pan Am 1736 if they were clear of the runway, they used the “papa alpha” call sign. The other flight crews did not understand that this callsign referred to the Pan Am clipper jet. All of the non-standard language had a negative impact on what each of the crews thought the situation was.

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5 – 4 – 3 – 2 – 1 Review

Purpose

This activity introduces students to five different metacognitive exercises for demonstrating your understanding of the reading. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Define/explain at least 5 Key terms/Concepts from the reading.
2. Create at least 4 practice 'test' questions.
3. Imagine you are talking to someone about at least three concepts you learned from this reading. Explain those concepts in enough detail so that someone unfamiliar with the concepts can understand them.
4. Imagine you are talking to someone about two concepts you found interesting from the reading that you want to learn more about. Explain those two things in enough detail so that someone unfamiliar with the concepts can understand them. Include a reference to a source that explains the concept beyond what was covered in the reading.
5. Identify at least one topic/concept you did not understand from the reading and ask the instructor a question.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.

- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Include page numbers from the reading for each task.
- If including abbreviations in task #1, they must be explained/defined beyond simply spelling out the abbreviation.
- For task #2 do not include more than 2 true/false questions and do not repeat the questions included in the reading.
- Your explanations for tasks #3 and #4 must be at least 50 words. Meeting the word count may not ensure you have sufficient detail to explain the concept to someone who isn't familiar with the topic.
- In-text citations and end-of-text references are only required if you use a source other than this reading (Task #4 for instance). But remember your page numbers for each topic in each task.

Content Area	Yes	Developing	No
The Key terms: are Defined Correctly are In Full and Complete Sentences include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Practice Test Questions: are Unambiguous and Correct include Appropriate Question Types include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Topics Learned: are Clear and Correctly Explained are in Full and Complete Sentences in Sufficient Detail include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Interesting Topics:	No errors	1-2 Errors	More than 2 errors

are Clear and Correctly Explained are in Full and Complete Sentences include Sufficient Detail include Page Numbers			
The question for the instructor is: Clear in Full and Complete Sentences includes a Page Number Related to the module topics	No errors		1-2 Errors
The included topics show full coverage of the material.	One of the following is acceptable: - Two topics were duplicated. - One topic was included in 3 task sections		One or more of the following: - Three or more topics were duplicated. - One topic was included in more than 3 areas - One task section was entirely incomplete. - 2 task sections were partially incomplete.
Blacked out performance criteria means that criterion is not applicable to that content area.			

Learning Log

Purpose

This activity provides the opportunity to reflect on the reading to demonstrate your understanding. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

These questions are adapted from Fernald (2004) as cited in Carney, A.G., Fry, S.W. Gabriele, R.V. & Ballard, M. (2008). Reeling in the big fish: Changing pedagogy to encourage the completion of reading assignments. *College Teaching, 56*(4). 195-200. https://doi.org/10.3200/CTCH.56.4.195-200

Tasks

1. Answer the following questions:
    a. Describe the major thesis, the central idea or set of ideas, in the reading. Also include one or two closely related ancillary or secondary ideas or theses, clearly identifying them as such.
    b. Identify *two concepts or principles* presented in the chapter or article and, when you first mention each, italicize it and define it. Then, show how the concepts or principles in some way(s) are both similar to and different from one another. If you wish, one of the concepts or principles may be selected from another reading, lecture, or discussion in this course.
    c. Select a *concept or principle* in the chapter or article, italicize it, clearly define or describe it, and then indicate how it applies to you or someone you know. Provide sufficient details to justify convincingly that the concepts or principle indeed applies as you suggest.

d. Write a critical perspective on some aspect of the chapter or article, citing evidence that prompts you to agree or disagree with the author's perspective. Note that a critique may be positive, negative, or some combination of both. Your evidence may be based on (1) personal experience, (2) observations of others, (3) reports of others, (4) scientific findings, or (5) logic. When citing evidence, identify the type(s) of evidence you are using.

e. Citing page number(s), quote verbatim a statement or brief passage that elicits in you some type of emotional response: excitement, frustration, pleasure, anger, sadness, surprise, confusion, fear, delight, some combination of the aforementioned, or whatever. Then identify your emotional response, describe the meaning(s) that the statement or passage has for you, and provide actual or possible reasons for your response.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Complete all 5 learning log prompts.
- Even if this assignment is typed, a hardcopy counts as "handwritten notes", remember the page count still applies for the test.

- You are allowed to cover the same topics in multiple tasks, but the full range of tasks should show your full coverage and understanding of the module reading.
- Each prompt is worth 4 points:
    - 2 points for accuracy (where appropriate), clarity, and detail (your answers should be at least 100 words).
    - 1 point for complete sentences with correct grammar and spelling.
    - 1 point for a topic sentence and page number(s).

True/False Questions

Purpose

The purpose of this assignment is to provide an answer to the T/F questions embedded in the reading to demonstrate your understanding of module concepts. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Review the True/False questions in the reading (shown in purple boxes).
2. Answer whether the question is True or False.
3. If the answer is false, rewrite the statement as a true statement.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- 5 Points – Each statement includes page numbers from the reading.
- 1 Point for each correctly identified true statement.
- 1 Point for each false statement rewritten as a true statement.
    - Some statements can be rewritten in multiple ways; please include all true statements.

- Each statement must be a complete sentence with correct grammar and spelling. Points will not be assigned for statements with grammar or spelling mistakes that change the meaning of the statement or make understanding the statement difficult.
- You cannot just add or remove the word “not” (or an equivalent basic change to the statement). If the statement can be changed to a true statement by adding or removing “not,” you must also include why that statement is true (i.e., “not…because”).

Make Connections

Purpose

The purpose of this assignment is for students to demonstrate their understanding of module concepts by providing answers to the green "Make Connections" prompt boxes embedded throughout the reading. Remember, the connections may not be "synonymous" but may be opposite terms or any other type of relationship. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Review the "Make Connections" prompts in the reading (shown in green boxes).
2. Answer the prompt and provide evidence to explain why you made that connection. The evidence should not be a simple definition of each concept, but instead, explain in your own words based on the concept's meaning why you think they are connected.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Each connection is worth 2 points:
    - 1 point – Connection is logical and explained in detail. Explanation must be at least 50 words. Meeting the word count may not ensure you have sufficient detail

to explain the concept.

- .5 points – Includes page numbers from the reading.
- .5 points – Explanation is in complete sentences with correct grammar and spelling.

Study Questions

Purpose

The study questions allow students to demonstrate their understanding some (not all) key human factors concepts from the reading. Your answers should be included in your notes for studying.

Tasks

- Complete the reading and answer the following questions.
    1. Blunt-end employees typically contribute to _____ conditions, and sharp-end employees typically contribute to _____ conditions.
    2. Humans are viewed as a _____ in the Old View of Safety and a _____ in the New View.
    3. What perspective should an investigator take when conducting an investigation?
    4. Which component of the SHELL model is least predictable? Why?
    5. What is the focus of the SHELL Model?
    6. Which component of the SHELL Model refers to the human?
    7. Which accident causation model is the Human Factors Analysis and Classification System (HFACS) based?
    8. At which HFACS level is the poor allocation of resources a failure?

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.

- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Each question is worth 2 points:
    - 1 point – Each answer is accurate and clear.
    - .5 point – Each answer is rewritten as a definitive statement that restates the question and is in complete sentences with correct grammar and spelling.
    - .5 point – Each statement includes page numbers from the reading.

Case Study Timeline

Purpose

In this activity, students will construct a timeline of their case study by applying the concepts discussed in the reading. This timeline will help you identify key findings from your case study which will provide a start for your case study evaluation.

Tasks

- **Before Class:**
  1. Review your case study.
  2. As an individual, construct a timeline of the safety event.
  3. Submit your timeline by the deadline.
- **In Class:**
  1. Work with your group members to construct a group timeline of the case study.
  2. No submission of the group timeline is required. You are expected to update this timeline throughout the semester.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the materials and technology necessary for the assignment, the assignment rubric, and any other embedded links.
- This assignment does not require an APA Student Title Page.
- This is an individual assignment; but since multiple students are reviewing the same Case Study, students may have eerily similar (not identical) answers to a peer.

- Remember when developing your timeline, it should include the active failure and the catastrophic event.
- Choose a time interval that is appropriate for your case study. Group members may use a different time interval, but you will have to standardize the interval when you complete the group timeline.
- Include a full reference for your case study, and include a page number for each finding, even if it is a paraphrase. Including the page number will help you expand the timeline or review the findings later.
- This assignment is worth 15 points:
    - Individual Student Submission
        - 4 Points – Included enough findings the investigator is able to get started on the evaluation (at least 10 findings).
        - 2 Points – Included the active failure and catastrophic event.
        - 2 Points – Included time stamps in between the findings.
        - 2 Points – Included a Case Study reference and page numbers for each finding.
    - 5 points - The student participating in constructing in the group timeline (points can be assigned even if the student does not submit an individual timeline).

Discussion Questions

Purpose

This activity requires students to demonstrate understanding of module concepts through discussion with peers. The questions aim to help you start thinking critically about human factors concepts from the reading so that you are able to clearly articulate your thoughts. Your answers should be included in your notes for studying. Including page numbers can help while you study.

Tasks

- **Before class, complete the reading and answer the following discussion preparation notes:**
    1. In your own words, describe what CRM is and what it means to you.
    2. In your own words, describe what human factors is and what the concept means to you.
    3. Explain the views and perspectives an investigator may take in an investigation. Which part of the organization does each view focus on?
    4. Which view and perspective will you take in your investigation? Why?
    5. Explain two of the models used to analyze aircraft accidents.
    6. Make three connections between at least two of the investigation models. Your connections must utilize key terms. Remember to explain/define the key terms and the connections.
    7. Which model do you think is best to use for analyzing aircraft accidents? Why?
- **In-Class you must actively participate in the discussion.**
    1. Bring a copy of your notes.

2. Discuss your answers with your group.
3. Share your answers with the class.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- **Discussion Preparation Notes:**
    - Can be typed or handwritten (must be legible, if it can't be read, it can't be graded).
    - In-text citations and end-of-text references are only required if you use a source other than this reading.
    - Do not forget your page numbers for each question.
- **In-Class Discussion:**
    - You must have a copy of your discussion preparation notes to actively participate in the discussion.
    - You must be present in class for the full activity to earn credit for the discussion.

	Yes	Developing	No
Were the Discussion Preparation Notes submitted on time, complete, and accurate?	All of the following: - Complete Notes were submitted on time before the in-class discussion. - Notes were legible, accurate, and complete. - Notes include the page number for all question		One of the following: - File was not submitted on time. - Submission was not legible and could not be graded. - Submission did not include the page number for 2 or more questions. - 2 or more of the questions were not completed, partially incomplete, or were not correct.
Was the student an active participant in the Group Discussion?	All of the following: - The student acts professionally, stays on topic, and manages their time well. - Students was able to contribute to the discussion beyond the assigned questions by asking questions and answering peer questions. - Student was prepared for the group discussion by submitting their Discussion Preparation Notes on time and bringing a hard copy to class.	Student actively participated in the discussion but was not prepared (one of the following): - Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a copy of the notes to class.	One of the following: - Student did not participate in the discussion. - Student was not present for the whole discussion. - Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class.
Was the student an Active participate in the Class Discussion?	All of the following:	Student actively participated in the discussion but was not	One of the following: - Student did not participate in the discussion.

	- The student acts professionally, stays on topic, and manages their time well. - Student was prepared for the group discussion by submitting their Discussion Preparation Notes on time and bringing a copy to class. - The student was able to successfully articulate their thoughts to the class and answer appropriate follow-up questions.	prepared (one of the following): - Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a hard copy of the notes to class.	- Student was not present for the whole discussion. - Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class
Blacked out performance criteria means that criterion is not applicable to that content area			

Small Group Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

1. Complete the discussion preparation notes.
2. Attend class for the scheduled module discussion and actively participate in the group discussion.
3. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and group discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on the question a peer asked you during the discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the group discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked a peer during the discussion.
    i. What did you ask?
    ii. Why did you ask this question?
    iii. What was the answer?
    iv. Did the answer help you better understand the concept, the question, your peer, or something else?
e. Briefly reflect on your preparation for the in-class discussion.
    i. Did you complete the preparation notes?
    ii. How seriously did you take the completion of the preparation notes?
    iii. Did you put aside sufficient time to complete the notes without stressing?
    iv. Did you bring a copy of the preparation notes to class?
    v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Class Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

1. Complete the discussion preparation notes.
2. Attend class for the scheduled module discussion and actively participate in the class discussion.
3. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and class discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on a question a peer asked during the class discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the class discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked during the discussion.
    i. What did you ask?
    ii. Why did you ask this question?
    iii. What was the answer?
    iv. Did the answer help you better understand the concept, the question, or something else?
e. Briefly reflect on your preparation for the in-class discussion.
    i. Did you complete the preparation notes?
    ii. How seriously did you take the completion of the preparation notes?
    iii. Did you put aside sufficient time to complete the notes without stressing?
    iv. Did you bring a copy of the preparation notes to class?
    v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Analysis Practice

Purpose

This is a scaffolding/formative assignment that supports the Case Study Evaluation Paper. In this activity you will practice identifying the human factors present in the case study and deconstructing the factor to support your analysis. Students will apply academic integrity procedures to support their viewpoint by including APA formatting requirements such as in-text citations, and references to prepare for the Case Study Evaluation paper.

Objectives

Through this assignment you will **practice** the objectives to 1) Evaluate aviation safety and the impact of human factors on safety, 2) communicate effectively, using written communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses...

Tasks

1. Review the "Analysis Practice" prompts in the reading (shown in orange boxes).
2. Completing an analysis of the human factors in the assigned case study.
    a. Identify the specific human factor present in the case study.
    b. Provide reading evidence in the form of a definition/explanation and citation of the human factor you identified.
    c. Include case study evidence in the form of a finding from the case study with a citation to support why you think that human factor was present.
3. Write your answers in a paragraph with complete sentences. Include a topic sentence that introduces the main idea and a concluding sentence that summarizes the main idea.

4. Share your answers with a class peer using a method where you can collaborate asynchronously and see updates as they happen.
5. Review the "Criteria for Success" for this assignment and provide feedback to your peer.
    i. At least one thing you learned.
    ii. At least two areas for improvement.
    iii. At least three strengths.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- The KLM Flight 4805 and Pan Am 1736 at Tenerife Analysis provides an example.
- This is a scaffolding assignment for the Case Study Evaluation Paper therefore the Criteria for Success are similar.
- This is an individual assignment; students should not have the same answers as a peer.
- **Practice Analysis:**
    - Your answers must be in paragraph form (including a topic sentence) with correct grammar, sentence structure, and spelling.
    - The key terms/concepts you identify in your analysis must demonstrate a deeper understanding of human factors concepts, therefore the term/concepts you identify in italics must be specific such as "decision error" and not just "error". But you can still define/explain the term "error" to help your audience gain a better understanding.

  - Specific human factors key terms/concepts must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and correctly cited. Italics help draw the reader's attention to those terms and their explanations. Paraphrased definitions/explanations demonstrate your understanding of the concepts. Citations show where you retrieved the information and provide evidence of why your analysis should be trusted.
  - Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis and evaluation for your audience.

- **Asynchronous Collaboration**
  - Make sure not to rely on your knowledge of the topic, your peer needs to clearly explain all concepts and acronyms.
  - Your answers must be in paragraph form with complete sentences with correct grammar and spelling.
  - Feedback must refer to a specific example from the peer's paper.
  - Feedback must focus on assignment requirements and not just personal opinions.

	Yes	Developing	No
Are the APA In-text Citations and End of Text References formatted correctly?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Is the paragraph organization logical and does it add to the understanding of the topic and assignment purpose?	Paragraph organization is logical and includes a topic sentence and concluding sentence.		
Are the Mechanics (grammar, sentence structure, and spelling) formatted correctly?	All of the following: - All acronyms are formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included to support the analysis?	The required number of key terms/concepts were identified, defined/explained, and cited.	One of the following: - 75% of the required key terms/concepts were identified, defined/explained, and cited. - The required number of key terms/concepts from the case study were identified,	

		defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the identification of the human factor key terms/concepts.	One of the following: - Cited findings from the case study are used incorrectly to support the identification of the human factor key terms/concepts. - Findings were interpreted incorrectly. - The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	Cited findings from the case study are absent or the cited findings from the case study focus more on reporting what happened and not supporting the analysis.
Did the student provide and submit for feedback asynchronously?	The student submitted the file for feedback and provided appropriate feedback.		
Blacked out performance criteria means that criterion is not applicable to that content area.			

Chapter 6 Module 2

Ethics and Professionalism

There is no easy universal definition of ethics (Benton, 1995, p. 22; Velasquez et al., 2010). *Ethics* comes from the Greek ethos, meaning "customs, conduct or character" (Northouse, 2013, p. 424). It was once believed that a person's sense of ethics was part of their personality by the time they turned 10 or 12. People now believe that our ethics grow and evolve as we do (Piper, Gentile, and Parks, 1993, as cited in Benton, 1995, p. 23). For our purposes, we will avoid defining "good or bad ethics"; instead, we will study the different approaches to ethics. Professionalism and ethics go hand in hand (Benton, 1995, p. 22), a relationship especially pronounced in the aviation industry. *Professionalism* can be defined as "understanding the principles and values in airmanship" (Ebbage & Spencer, 2003, p. 6). Our discussion on ethics and professionalism will introduce different ethical approaches, how ethics are practiced in the aviation industry, and how they impact decision-making.

Ethical Approaches

Ethical approaches are categorized as teleological and deontological (Northouse, 2013, pp. 424-425; 426). The term *teleological* is derived from the Greek telos, which means "'ends' or 'purposes" (Northouse, 2013, pp. 424-425; 426). These approaches define ethical behavior based on the consequences of people's behavior and decisions. *Deontological* approaches focus on people's "duty" or responsibilities as defined by a universal law.

Teleological Approaches

Because teleological approaches concentrate on the consequences of our actions, they are also referred to as consequentialist ethics (Waymack, 2019a, p. 6). Typically, when humans make a decision, we have an intended outcome or goal. In consequentialist ethics, those decisions are assessed based on how well they achieved that intended outcome. Consequential ethics can be categorized by who experiences the consequences of the decisions.

Table 4-13
Consequences of Teleological Ethics adapted from Northouse (2013)

Teleological Approach	Who Experiences the Consequences
Ethical Egoism	Ourselves
Altruism	Others
Utilitarianism	Everyone

Ethical Egoism. When we make decisions based on how they will directly impact us, that is *ethical egoism* (Waymack, 2019a, p. 7). Self-interested people will make decisions that will benefit them. Arguably, always making decisions that only benefit you would not make you a particularly good person. However, I had a flight student who always answered, "My favorite person is in this airplane," when I reminded him to be safe and make good decisions. He was

making decisions based on the beneficial outcome, a safe return for himself, resulting in a safe return for the airplane and others in the national airspace.

Altruism. When we ignore our self-interest and focus on the interests of others, we make *altruistic* decisions (Waymack, 2019a, p. 8). Altruistic ethics are concerned with the consequences for others. An example of this would be admitting when we do something wrong regardless of the negative consequences for ourselves.

Utilitarianism. Most of us cannot say we consistently make altruistic decisions. Our self-interests always make an appearance. Nevertheless, we know that society will never accept us if we only make decisions based on our self-interest. That is where the third "who" comes into play. *Utilitarianism* looks at the favorable benefits for everyone or most people in society (Waymack, 2019a, p. 8). Utilitarianism defines good consequences concerning how much happiness they bring and harmful consequences concerning pain and suffering.

It may be hard for you to think about making aviation decisions in connection with happiness, instead substituting 'safety' for happiness. In aviation, we should make all decisions based on everyone's safety. Regardless of which consequential approach you believe in or adhere to, those consequences may reach farther than those immediately involved in the decision (Waymack, 2019a, p. 10). As aviation professionals, we continually set an example of appropriate behavior. Young children at the airport, subordinates, and colleagues watch us to know how a professional behaves. We do not always see who is watching us, so we must always set the right example.

Deontological Ethics

Deontological ethics judge decisions and actions "based on whether or not human actions accord with a universal rule of morality" (Waymack, 2019a, p. 11). How do we define one

universal rule of morality in a multicultural, diverse world? How can we tell another culture what is right or wrong? The answer is that we cannot. We will only concern ourselves with aviation industry-accepted standards and practices as a universal law. We will discuss working in a multicultural organization and society later.

Immanuel Kant. Because our decisions do not consistently achieve the intended outcomes, Immanuel Kant thought people should not be held accountable for the consequences of their actions. However, we can only be responsible for our intentions (Waymack, 2019a, p. 12). Therefore, if we find ourselves in a situation that we have never experienced and follow all regulations and standard operating practices (SOPs) to save lives, we cannot be judged for the decision if the outcome differs from what we intended. Kant's beliefs are considered deontological because he advocated for only taking actions that could be attributed to a *universal law* (Kant, 1964, p. 88, as cited in Waymack, 2019a, p. 13). For example, it is okay to violate SOPs if it is **always** okay to violate SOPs. Kant believed that people should be respected, their autonomy (ability to think for themselves) maintained, and they should be treated as an end in themselves, not just a means-to-an-ends. This means that subordinates should be supported and not just treated as tools, which will be explored more when we discuss leadership.

T/F. Teleological ethics define behavior based on people's "duty" or responsibilities as defined by a universal law.

T/F. Utilitarianism looks for the favorable benefits for everyone (or most people) in society.

T/F. Kant's beliefs are considered altruistic.

T/F. Self-control is a virtue identified by Aristotle.

Virtue Theory

Virtue theorists believe morality exists more in our character, and moral character can be taught and practiced (Northouse, 2013, p. 427; Waymack, 2019b, p. 21). When practiced, this

moral character or *virtue* becomes part of our personality. Aristotle identified several moral characteristics, including "courage, temperance, generosity, self-control, honesty, sociability, modesty, fairness, and justice" (Northouse, 2013, p. 427).

Professionalism

In his book "Redefining Airmanship," Tony Kern (1997) establishes a framework to optimize an aviator's ethical and professional decision-making. *Airmanship* is a "personal state that enables aircrew to exercise sound judgment, display uncompromising flight discipline, and demonstrate skillful control of an aircraft and a situation. It is maintained by continuous self-improvement and a desire to perform optimally at all times." (Ebbage & Spencer, n.d., p. 2). Ebbage and Spencer (n.d.) defines professionalism as "[u]nderstanding the values and principles embodied in airmanship" (p. 6).

The airmanship model starts with a foundation of discipline followed by skills and proficiency (Kern, 1997, p. 22). These principles guide a professional in pursuing the five pillars of knowledge: knowledge of self, aircraft, team, environment, and risk. By maintaining the discipline to achieve skill and proficiency in the five knowledge areas, aviators can build the situational awareness necessary to exercise sound judgment.

Before we continue the discussion on airmanship, I want to stress that although this model was designed with pilots specifically in mind, we will broaden it to apply to all aviation professionals. With the right mindset, you can apply the airmanship model to all aspects of your life.

Airmanship is not limited to flight or mechanic skills but includes soft skills like decision-making and a dedication to life-long learning. Effective airmanship requires aviation professionals to control a situation using critical and creative thinking in addition to their

training. Since airmanship includes established policies, procedures, and behaviors, it is a deontological and virtue approach to ethics.

Discipline

First, airmanship requires discipline (Kern, 1997, p. 28). *Discipline* "is the ability and willpower to safely employ an aircraft with operational, regulatory, organizational and common-sense guidelines" (Kern, 1997, p. 29). There are several things to keep in mind regarding failures in discipline:

1. Failures negatively impact our decision-making.
2. Failures, once accepted, tend to spread and become the new norm.
3. The best preventative measure is not to accept any deviations in discipline.

Failures to maintain discipline "are conscious and willful" (Kern, 1997, p. 29). Kern (1997) identified "five common rationalizations for poor flight discipline" (p .31):

1. If no one knows about the infraction and nobody gets hurt, what is the problem?
2. Everyone knows that there are safety margins built into all the regulations.
3. Rules are to protect inept flyers from themselves.
4. This business is over-regulated.
5. I cannot push the envelope and improve if all these silly rules bind me.

To counteract the first rationalization, remember the second statement regarding failures in discipline. Once we accept failures in discipline, they become the norm (Kern, 1997, p. 21; 38). This is commonly referred to as procedural creep or normalization of deviance. It is like when you drive five miles over the speed limit once, so you keep doing it. Eventually, you are driving ten miles per hour over the speed limit. It also relates to Immanuel Kant. If you establish a universal law that it is okay to violate SOPs, then it is always acceptable to violate SOPs.

If that is not enough to keep you from letting your discipline lapse, consider the ethical approaches discussed earlier. Any failure in discipline is an egoistic decision, meaning you are doing it to benefit yourself and ignoring the consequences for anyone else. So, you believe that the industry is over-regulated? In that case, those regulations are only designed to keep unskilled professionals from hurting themselves, and the rules keep you from reaching your true potential, you are making a few critical assumptions. You assume everyone else follows the rules, but what if they are like you? We have lost the "built-in safety margins" (Kern, 1997). You are assuming your breakdown in discipline is isolated to this one thing, but what if **you** are the unskilled professional these rules were designed to protect against because you failed to maintain discipline when learning your aircraft, tools, regulations, or other knowledge area?

You also assume that rules and requirements are designed to stifle your creativity and abilities, forgetting that those policies were paid for in blood (literally, in many cases). I like to use the example of the desiccate packets in a new pair of shoes that say, "Do Not Eat," and you know someone, somewhere, did something ridiculous and ate that desiccate packet! The aviation industry's regulations and standard operating procedures have been hard-won through the loss of life. Those rules are designed to prevent further loss of life, not stifle your abilities.

The aviation industry is no longer the place for barnstormers and risk-takers who "get the job done regardless of the risk" (Kern, 1997, p. xxv). The industry requires professionals who will not accept lapses in discipline but will instead establish professional discipline, which provides a foundation to build their skills and proficiency.

Skills and Proficiency

Airmanship *skills* not only require the physical skills to complete our jobs (such as flying or mechanical skills) but also require non-technical skills (communication, decision-making,

team, self-assessment, and resource management) (Ebbage & Spencer, n.d., p. 6; Kern, 1997, p. 50). To reach our highest level of success, professionals must create a professional development plan that requires a dedication to self-reflection and life-long learning (Kern, 1997, p. 51). The discipline necessary for self-improvement requires an honest self-awareness of strengths and weaknesses.

Kern (1997) established four levels to acquiring skills:

- Safety – enough skill to be safe
- Effectiveness – enough skill to complete the requirements of our job
- Efficiency – enough skill to complete our job with the minimum resources
- Precision and continuous improvement – enough skill to participate in self-reflection and improvement

A personal development plan can allow you to acquire skills by clearly identifying the skill you want to acquire, identifying the resources necessary to acquire the skill, spell out the requirements necessary to acquire the skill, establish clear objectives, make a clear plan for skill acquisition, then complete the training and evaluate the outcome (Kern, 1997, p. 66).

Proficiency goes beyond skill acquisition by requiring professionals to maintain their skill set through regular use and practice (Kern, 1997, p. 60). The development of skills and proficiency can be hindered by "poor self-assessment," "lack of focus for improvement," and "inability to accept criticism" (Kern, 1997, pp. 320-323).

Knowledge

Knowledge of self requires attention to self-reflection and self-improvement. This mindset supports lifelong learning, the lifelong pursuit of knowledge and skills. Knowing yourself can be prevented by being overly critical, overly optimistic, and an "undisciplined self-

assessment process" (Kern, 1997, p. 323). Throughout this course, you will complete several self-reflection activities to identify your strengths and areas for improvement.

Knowledge of the aircraft or the other tools required for your profession is beyond the scope of human factors, except for the interaction between the human and the technical aspects of the job.

Knowledge of a team requires knowledge of your team members' knowledge, skills, and abilities. In addition, professional integrity requires all crew members to be honest about their abilities and be able to discharge the duties of their job (Kern, 1997, p. 125). Often, pilots work with different people they have never worked with before. Companies train their pilots in Crew Resource Management and follow checklists and procedures to minimize the time necessary for people to come together and form a team. Effective team members exercise active listening, evenly distribute workload, provide feedback, practice conflict resolution strategies, and proactively address problems by monitoring and supporting one another (Kern, 1997, p. 129). Teamwork will be discussed in more detail in Leadership, Followership, and Teamwork.

Knowledge of the environment includes the physical environment (weather and workspace layout) and the regulatory environment (FAA regulations and organizational policies and procedures) (Kern, 1997, p. 182).

Knowledge of risk requires the ability to identify hazards and assess risk. According to the FAAs (2022) *Risk Management Handbook*, a *hazard* "is a present condition, event, object, or circumstance that could lead to or contribute to an unplanned or undesired event such as an accident." (p. 3-1). Hazards are only sometimes readily apparent; they may require the individual to anticipate how a situation may develop. Regulations help professionals avoid hazards by limiting certain behaviors, such as flying in poor weather.

Once a hazard has been identified, the risk associated with the event can be assessed. *Risk* is a "composite of predicted severity and likelihood of the potential effect of a hazard." (FAA, 2022, p. 3-1). An informal method is to ask yourself, "Is it safe, is it legal, and does it make sense?" (FAA 2009, p. 1-6). Once the risk has been assessed, individuals can manage it by eliminating or mitigating it. According to the FAA (2022), risk management requires discipline; people must look at potential hazards logically and rationally instead of looking at the situation from self-interest. If the level of risk has been accepted, the individual may need to continue updating their assessment as the situation unfolds.

Situational Awareness and Judgment

Situational Awareness (SA) is a person's mental model (or picture of what is going on) of the environment and requires an accurate perception and understanding of the elements in the work environment and an estimation of how those elements will change in the future (FAA, 1991, p. iii[iv]). The five knowledge areas are necessary to understand the elements in the environment in order to be able to form an expectation of what will happen in the future.

Judgment is the mental decision-making process (Jensen, 1982 as cited in Jensen, 1995). SA and the decision-making process will be covered in detail in Information Processing.

T/F. Professionals must exhibit professional discipline before achieving any amount of airmanship.

T/F. Professionals require knowledge of risk.

T/F. Failures in discipline can negatively impact decision-making.

T/F. If professionals can complete a task safely, they do not have to acquire any further skill level.

Make connections between the Airmanship Model and one of the Models from Introduction to Human Factors.

Airmanship	Connection
Discipline	
Skills and Proficiency	
Knowledge Area (be specific)	
Situational Awareness	
Judgment	

Analyze the following information from the NTSB report on Colgan 3407.

In 2006, the FAA issued a Safety Alert for Operators to emphasize sterile cockpit rules and that non-compliance with this regulation contributed to a recent accident (NTSB, 2010, p. 57). "[Colgan] Check airmen stated that, during check rides, captains were expected to brief sterile cockpit procedures before the flight, and the procedures were expected to be followed during the flight." (NTSB, 2010, p. 45). As the Colgan 3407 flight crew descended below 10,000 feet (approximately 2206:37), the crew participated in non-pertinent conversation off and on until after they had completed the descent and approach checklists (about 9 minutes later) (NTSB, 2010, p. 92).

Concept	What concept(s) is/are present?	Evidence (explain why)
Ethical Approach(es)		
Airmanship Component(s)		

In Conclusion

A decision using any of the ethical approaches we have discussed can be considered an "ethical decision." However, making decisions using ethical egoism only would not get you far in the aviation industry. Not many people would want to work with someone who only made decisions that benefited them. Altruistic decisions would get you a little farther, but professional and career ambition requires some self-interest. With that in mind, the most appropriate approach would be utilitarianism. However, as mentioned earlier, one culture does not have the right to tell another culture what universal law is most "ethical." In the aviation industry, we should strive to maintain the foundations of airmanship, which combines professionalism and ethics into an industry-universal law. Airmanship ensures that professionals continually pursue the knowledge, skills, and attitudes to make the best decisions.

Key Term Index

Ethics and Professionalism Analysis of KLM Flight 4805 and Pan Am 1736 at Tenerife

Ethics can be defined in terms of who experiences the consequences (*teleological*) and decisions following a universal law (*deontological*) (Waymack, 2019a; Waymack, 2019b). Standard operating procedures (SOPs) act as the universal law for the aviation industry, and the KLM captain violated multiple SOPs when he continued the takeoff roll (Federal Aviation Administration [FAA], n.d.). He lacked situational awareness and thus did not have the requisite information to make the correct decision regarding the consequences to himself and other parties.

When *professionalism* is defined as "understanding the principles and values in airmanship" (Ebbage & Spencer, 2003, p. 6), it is easy to see critical failures in professional decision-making in this case. First, airmanship is built on a foundation of *discipline*, "the ability and willpower to safely employ an aircraft with operational, regulatory, organizational and common-sense guidelines" (Kern, 1997, p. 29). Airmanship requires knowledge in five areas, *including knowledge of the environment,* which requires professionals to understand how the organizational environment can influence decisions (Kern, 1997). The crew was worried that if they could not take off by a specific time, they would violate the company's duty day limitations (FAA, n.d.). When considering this factor in his decision-making, the captain demonstrated knowledge of the environment. However, it showed a failure in discipline when he allowed that pressure to lead to a takeoff without clearance.

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5 – 4 – 3 – 2 – 1 Review

Purpose

This activity introduces students to five different metacognitive exercises for reviewing the reading. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Define at least 5 Key terms/Concepts from the reading.
2. Create at least 4 practice 'test' questions.
3. Imagine you are talking to someone about at least three concepts you learned from this reading. Explain those concepts in enough detail so that someone unfamiliar with the concepts can understand them.
4. Imagine you are talking to someone about two concepts you found interesting from the reading that you want to learn more about. Explain those two things in enough detail so that someone unfamiliar with the concepts can understand them. Include a reference to a source that explains the concept beyond what was covered in the reading.
5. Identify at least one topic/concept you did not understand from the reading and ask the instructor a question.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.

- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Include page numbers from the reading for each task.
- If including abbreviations in task #1, they must be explained/defined beyond simply spelling out the abbreviation.
- For task #2 do not include more than 2 true/false questions and do not repeat the questions included in the reading.
- Your explanations for tasks #3 and #4 must be at least 50 words. Meeting the word count may not ensure you have sufficient detail to explain the concept to someone who isn't familiar with the topic.

The Key terms: are Defined Correctly are In Full and Complete Sentences include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Practice Test Questions: are Unambiguous and Correct include Appropriate Question Types include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Topics Learned: are Clear and Correctly Explained are in Full and Complete Sentences in Sufficient Detail include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Interesting Topics: are Clear and Correctly Explained are in Full and Complete Sentences include Sufficient Detail include Page Numbers	No errors	1-2 Errors	More than 2 errors
The question for the instructor is: Clear in Full and Complete Sentences	No errors		1-2 Errors

includes a Page Number Related to the module topics			
The included topics show full coverage of the material.	One of the following is acceptable: - Two topics were duplicated. - One topic was included in 3 task sections		One or more of the following: - Three or more topics were duplicated. - One topic was included in more than 3 areas - One task section was entirely incomplete. - 2 task sections were partially incomplete.
Blacked out performance criteria means that criterion is not applicable to that content area.			

Learning Log

Purpose

This activity provides the opportunity to reflect on the reading to demonstrate your understanding. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

These questions are adapted from Fernald (2004) as cited in Carney, A.G., Fry, S.W. Gabriele, R.V. & Ballard, M. (2008). Reeling in the big fish: Changing pedagogy to encourage the completion of reading assignments. *College Teaching, 56*(4). 195-200. https://doi.org/10.3200/CTCH.56.4.195-200

Tasks

2. Answer the following questions:
    a. Describe the major thesis, the central idea or set of ideas, in the reading. Also include one or two closely related ancillary or secondary ideas or theses, clearly identifying them as such.
    b. Identify *two concepts or principles* presented in the chapter or article and, when you first mention each, italicize it and define it. Then, show how the concepts or principles in some way(s) are both similar to and different from one another. If you wish, one of the concepts or principles may be selected from another reading, lecture, or discussion in this course.
    c. Select a *concept or principle* in the chapter or article, italicize it, clearly define or describe it, and then indicate how it applies to you or someone you know. Provide sufficient details to justify convincingly that the concepts or principle indeed applies as you suggest.

d. Write a critical perspective on some aspect of the chapter or article, citing evidence that prompts you to agree or disagree with the author's perspective. Note that a critique may be positive, negative, or some combination of both. Your evidence may be based on (1) personal experience, (2) observations of others, (3) reports of others, (4) scientific findings, or (5) logic. When citing evidence, identify the type(s) of evidence you are using.

e. Citing page number(s), quote verbatim a statement or brief passage that elicits in you some type of emotional response: excitement, frustration, pleasure, anger, sadness, surprise, confusion, fear, delight, some combination of the aforementioned, or whatever. Then identify your emotional response, describe the meaning(s) that the statement or passage has for you, and provide actual or possible reasons for your response.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Complete all 5 learning log prompts.
- Even if this assignment is typed, a hardcopy counts as "handwritten notes", remember the page count still applies for the test.

- You are allowed to cover the same topics in multiple tasks, but the full range of tasks should show your full coverage and understanding of the module reading.
- Each prompt is worth 4 points:
    - 2 points for accuracy (where appropriate), clarity, and detail (your answers should be at least 100 words).
    - 1 point for complete sentences with correct grammar and spelling.
    - 1 point for a topic sentence and page number(s).

True/False Questions

Purpose

The purpose of this assignment is to review the True/False questions included throughout the reading and provide an answer to those questions. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

4. Review the True/False questions in the reading (shown in purple boxes).

   Answer whether the question is True or False.

   If the answer is false, rewrite the statement as a true statement.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- 5 Points – Each statement includes page numbers from the reading.
- 1 Point for each correctly identified true statement.
- 1 Point for each false statement rewritten as a true statement.
    - Some statements can be rewritten in multiple ways; please include all true statements.

- Each statement must be a complete sentence with correct grammar and spelling. Points will not be assigned for statements with grammar or spelling mistakes that change the meaning of the statement or make understanding the statement difficult.
- You cannot just add or remove the word “not” (or an equivalent basic change to the statement). If the statement can be changed to a true statement by adding or removing “not,” you must also include why that statement is true (i.e., “not…because”).

Make Connections

Purpose

The purpose of this assignment is to review the green "Make Connections" boxes included throughout the reading and provide an answer to those prompts. Remember, the connections may not be "synonymous" but may be opposite terms or any other type of relationship. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Review the "Make Connections" prompts in the reading (shown in green boxes).
2. Answer the prompt and provide evidence to explain why you made that connection. The evidence should not be a simple definition of each concept, but instead, explain in your own words based on the concept's meaning why you think they are connected.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Each connection is worth 2 points:
    - 1 point – Connection is logical and explained in detail. Explanation must be at least 50 words. Meeting the word count may not ensure you have sufficient detail

to explain the concept.

- .5 points – Includes page numbers from the reading.
- .5 points – Explanation is in complete sentences with correct grammar and spelling.

Study Questions

Purpose

The purpose of this assignment is to help you identify some (not all) key concepts from the reading. Your answers should be included in your notes for studying.

Tasks

- Complete the reading and answer the following questions.

1. Define teleological and deontological ethics.
2. Identify the three types of teleological ethics and who experiences the consequences for each.
3. Describe Kant's beliefs.
4. What are the five areas of knowledge a professional must have to maintain airmanship?
5. Where would the virtue of self-control fit in the airmanship model?
6. A failure in judgment can ultimately be traced back to which airmanship principle? Why?
7. What is the best preventative measure against failures in discipline?
8. What are the five rationalizations for poor flight discipline?
9. How many levels of skill acquisition are there?

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.

- Each question is worth 2 points:
    1. 1 point – Each answer is accurate and clear.
    2. .5 point – Each answer is rewritten as a definitive statement that restates the question and is in complete sentences with correct grammar and spelling.
    3. .5 point – Each statement includes page numbers from the reading.

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Personal Code of Ethics

Purpose

This activity will give you the opportunity to apply module concepts to a code of ethics and develop your own based on course concepts.

Tasks

1. Review The International Society of Air Safety Investigators ISASI Code of Ethics and Conduct.
2. Connect at least **ten** statements from the Code of Ethics and Conduct to at least **seven** key terms/concepts in the reading.
3. Define the key terms/concepts from the reading and include a page number.
4. Briefly explain the connection between the code of ethics statement and the key term/concept.
5. Write a personal code of ethics with 5-10 statements relevant to your career choice. Do not include any statements verbatim (or almost verbatim) from the example code of ethics.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require an APA Student Title Page.
- This is an individual assignment; students should not have the same answers as a peer.
- You are allowed to cover the same topics on multiple statements, but the full range of key

terms and statements should show your full coverage of the entire reading.

- Each statement is worth 2 points:
    - 1 point –Key term and statement connections are logical and clearly explained.
    - .5 point – Key terms are clearly defined/explained with page numbers from the reading.
    - .5 point – The direct quotes from the code of ethics was included with a citation.

Discussion Questions

Purpose

This activity will give you the opportunity to prepare for a class discussion. The questions aim to help you start thinking critically about human factors concepts from the reading. Your answers should be included in your notes for studying. Including page numbers can help while you study.

Tasks

- **Before class, complete the reading and answer the following discussion preparation notes:**
    1. How do ethics and professionalism relate to your career as an aviation student?
    2. Is it possible to make an ethical decision that is not professional? Why or why not?
    3. Is it possible to make a professional decision that is not ethical? Why or why not?
    4. How can the foundations of airmanship be applied to non-flight situations?
    5. Provide an example of a specific skill you are building. What level of skill acquisition are you currently at, and how do you plan to obtain the next level?
    6. Provide an example of a time when you rationalized poor discipline. If you were in that situation again, how might you counteract that rationalization?
    7. Why do you think you should be conservative when conducting a self-assessment?
    8. Make three connections between at least one of the investigation models and the Airmanship Model. Your connections must utilize key terms. Remember to explain/define the key terms and the connections.
- **In-Class you must actively participate in the discussion.**
    1. Bring a copy of your notes.

2. Discuss your answers with your group.
3. Share your answers with the class.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- **Discussion Preparation Notes:**
    - Can be typed or handwritten (must be legible, if it can't be read, it can't be graded).
    - In-text citations and end-of-text references are only required if you use a source other than this reading.
    - Do not forget your page numbers for each question.
- **In-Class Discussion:**
    - You must have a copy of your discussion preparation notes to actively participate in the discussion.
    - You must be present in class for the full activity to earn credit for the discussion

	Yes	Developing	No
Were the Discussion Preparation Notes submitted on time, complete, and accurate?	All of the following: - Complete Notes were submitted on time before the in-class discussion. - Notes were legible, accurate, and complete. - Notes include the page number for all question		One of the following: - File was not submitted on time. - Submission was not legible and could not be graded. - Submission did not include the page number for 2 or more questions. - 2 or more of the questions were not completed, partially incomplete, or were not correct.
Was the student an active participant in the Group Discussion?	All of the following: - The student acts professionally, stays on topic, and manages their time well. - Student was able to contribute to the discussion beyond the assigned questions by asking questions and answering peer questions. - Student was prepared for the group discussion by submitting their Discussion Preparation Notes on time and bringing a hard copy to class.	Student actively participated in the discussion but was not prepared (one of the following): - Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a copy of the notes to class.	One of the following: - Student did not participate in the discussion. - Student was not present for the whole discussion. - Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class.
Was the student an Active participate in the Class Discussion?	All of the following: - The student acts professionally, stays on topic, and manages their time well. - Student was prepared for the group discussion by submitting their	Student actively participated in the discussion but was not prepared (one of the following):	One of the following: - Student did not participate in the discussion. - Student was not present for the whole discussion.

	Discussion Preparation Notes on time and bringing a copy to class. - The student was able to successfully articulate their thoughts to the class and answer appropriate follow-up questions.	- Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a hard copy of the notes to class.	- Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class
Blacked out performance criteria means that criterion is not applicable to that content area.			

Small Group Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

1. Complete the discussion preparation notes.
2. Attend class for the scheduled module discussion and actively participate in the group discussion.
3. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and group discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on the question a peer asked you during the discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the group discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked a peer during the discussion.
   i. What did you ask?
   ii. Why did you ask this question?
   iii. What was the answer?
   iv. Did the answer help you better understand the concept, the question, your peer, or something else?

e. Briefly reflect on your preparation for the in-class discussion.
   i. Did you complete the preparation notes?
   ii. How seriously did you take the completion of the preparation notes?
   iii. Did you put aside sufficient time to complete the notes without stressing?
   iv. Did you bring a copy of the preparation notes to class?
   v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Class Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

5. Complete the discussion preparation notes.
6. Attend class for the scheduled module discussion and actively participate in the class discussion.
7. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and class discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on a question a peer asked during the class discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the class discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked during the discussion.
    i. What did you ask?
    ii. Why did you ask this question?
    iii. What was the answer?
    iv. Did the answer help you better understand the concept, the question, or something else?
e. Briefly reflect on your preparation for the in-class discussion.
    i. Did you complete the preparation notes?
    ii. How seriously did you take the completion of the preparation notes?
    iii. Did you put aside sufficient time to complete the notes without stressing?
    iv. Did you bring a copy of the preparation notes to class?
    v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Analysis Practice

Purpose

This is a scaffolding/formative assignment that supports the Final Case Study Evaluation Paper.

In this activity you will practice identifying the human factors present in the case study and deconstructing the factor to support your analysis. Students will apply academic integrity procedures to support their viewpoint by including APA formatting requirements such as in-text citations, and references to prepare for the Case Study Evaluation paper.

Objectives

Through this assignment you will **practice** the objectives to 1) make professional and ethical decisions, 2) communicate effectively, using written communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses...

Tasks

1. Review the "Analysis Practice" prompts in the reading (shown in orange boxes).
2. Completing an analysis of the human factors in the assigned case study.
    a. Identify the specific human factor present in the case study.
    b. Provide reading evidence in the form of a definition/explanation and citation of the human factor you identified.
    c. Include case study evidence in the form of a finding from the case study with a citation to support why you think that human factor was present.

3. Write your answers in a paragraph with complete sentences. Include a topic sentence that introduces the main idea and a concluding sentence that summarizes the main idea.
4. Share your answers with a class peer using a method where you can collaborate asynchronously and see updates as they happen.
5. Review the "Criteria for Success" for this assignment and provide feedback to your peer.
    a. At least one thing you learned.
    b. At least two areas for improvement.
    c. At least three strengths.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- The KLM Flight 4805 and Pan Am 1736 at Tenerife Analysis provides an example.
- This is a scaffolding assignment for the Case Study Evaluation Paper therefore the Criteria for Success are similar.
- This is an individual assignment; students should not have the same answers as a peer.
- **Practice Analysis:**
    - Your answers must be in paragraph form (including a topic sentence) with correct grammar, sentence structure, and spelling.
    - The key terms/concepts you identify in your analysis must demonstrate a deeper understanding of human factors concepts, therefore the term/concepts you identify in italics must be specific such as "decision error" and not just

"error". But you can still define/explain the term "error" to help your audience gain a better understanding.

- Specific human factors key terms/concepts must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and correctly cited. Italics help draw the reader's attention to those terms and their explanations. Paraphrased definitions/explanations demonstrate your understanding of the concepts. Citations show where you retrieved the information and provide evidence of why your analysis should be trusted.
- Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis and evaluation for your audience.

- **Asynchronous Collaboration**
  - Make sure not to rely on your knowledge of the topic, your peer needs to clearly explain all concepts and acronyms.
  - Your answers must be in paragraph form with complete sentences with correct grammar and spelling.
  - Feedback must refer to a specific example from the peer's paper.
  - Feedback must focus on assignment requirements and not just personal opinions.

	Yes	Developing	No
Are the APA In-text Citations and End of Text References formatted correctly?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Is the paragraph organization logical and does it add to the understanding of the topic and assignment purpose?	Paragraph organization is logical and includes a topic sentence and concluding sentence.		
Are the Mechanics (grammar, sentence structure, and spelling) formatted correctly?	All of the following: - All acronyms are formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included to support the analysis?	The required number of key terms/concepts were identified, defined/explained, and cited.	One of the following: - 75% of the required key terms/concepts were identified, defined/explained, and cited. - The required number of key terms/concepts from the case study were identified,	

		defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the identification of the human factor key terms/concepts.	One of the following: - Cited findings from the case study are used incorrectly to support the identification of the human factor key terms/concepts. - Findings were interpreted incorrectly. - The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	Cited findings from the case study are absent or the cited findings from the case study focus more on reporting what happened and not supporting the analysis.
Did the student provide and submit for feedback asynchronously?	The student submitted the file for feedback and provided appropriate feedback.		
Blacked out performance criteria means that criterion is not applicable to that content area.			

Chapter 7 Module 3

Identifying and Managing Unsafe Acts

As discussed before, there are two views on human error: the Old View and the New View. In the Old View, also sometimes referred to as the person, human, or individual approach, human error is seen as an individual failure of one person (Dekker, 2014). Memory failures, physiological factors, lack of skill or knowledge, or poor decision-making could cause this failure. In the Old View of Safety, human error was seen as a cause of trouble, but in the New View, human error is seen as a symptom of systemic problems. The New View is often referred to as the organizational or system approach. This mindset says that human error is the starting point of an investigation, not the end. If an organization utilizes the Old View of safety, it seeks to legislate human error out of existence. The Old View implements new rules and procedures to mitigate human error. However, in the New View, the organization seeks to address the tasks, policies, and situations within which people work and attempt to adapt them to the human to mitigate human error.

Any human factors investigation must include latent and active failures (Reason, 1997, p. 10). Human error cannot be eliminated, but addressing latent conditions can remove them before

contributing to catastrophic events. Organizational accidents do not require active failures (Reason, 1997, p. 17). Accidents and incidents are more commonly caused by latent conditions than active failures (Reason, 1997, p. 129).

T/F. Effective managers must accept that errors cannot be completely prevented.

Latent Factors

Culture is the "shared motives, values, beliefs, identities and interpretations, or meanings of significant events that result from common experiences of members of collectives and are transmitted across age generations." (House et al., 1999, p. 184 as cited in Lumpe, 2008). Three cultures can impact human behavior: national, professional, and organizational (FAA, 2004). Professional Culture is unique to the individual's profession. Professionalism was discussed previously and forms the basis of the aviation professional culture. However, aviation mechanics, pilots, air traffic controllers, and other professionals may differ slightly in their accepted norms and practices.

"*National culture* differentiates the characteristics of particular nations, including the role of the individual within society, the manner in which authority is distributed, and national priorities with respect to resources, accountabilities, morality, objectives and legal systems." (ICAO, 2018, p. 3-3; italics added). National Culture is arguably best defined by Geert Hofstede's work. In his original research, four dimensions were defined to describe the differences between countries (Hofstede, n.d.). Later, two more dimensions were added.

- *Individualism versus Collectivism* – how much people act as individuals or act for the group (Hofstede & McCrae, 2004). Sorters and Boer (2000, as cited in Strauch, 2017, p. 141) found that countries that scored higher in individualism had fewer accidents than collectivistic countries.

- *Power Distance* – is power distributed equally, as perceived by those below, not from above (Hofstede & McCrae, 2004). When CRM was exported to countries with a higher power distance than the United States (where CRM originated), participants found it challenging to be more assertive, and superiors struggled to accept the input of their subordinates (Strauch, 2017, p. 141).
- *Masculinity versus Femininity* – the relationship between gender and expected gender roles. In masculine society, the genders are farther apart and closer together in feminine cultures (Hofstede & McCrae, 2004).
- *Uncertainty Avoidance* – how comfortable people are with uncertainty. High uncertainty avoidance means more structure and anxiety in unstructured situations (Hofstede & McCrae, 2004).
- *Long-term Orientation* – how much is the world fixed. Long-term cultures plan for the future and expect things to change. Short-term cultures look to the past to determine the present and future (Hofstede, n.d.).
- *Indulgence versus restraint* – how free is the pursuit of human desires (Hofstede, n.d).

Organizational Culture is an organization's "Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioral norms (the way we do things around here)" (Reason, 1997, p. 192). *Safety Culture* "is the engine that continues to propel the system towards the goal of maximum safety health, regardless of the leadership's personality or current commercial concerns" (Reason, 1997, p. 195). This Culture embodies the organization's dedication to safety.

A safety culture is made up of five subcultures:

- *Reporting Culture* encourages employees to report safety situations (Reason, 1997, p. 195). To report unsafe acts, people must not fear reprisals for the unintentional unsafe acts, which requires indemnity for unintentional unsafe acts, and the entity responsible for analyzing reports must be independent of those responsible for disciplinary action. It is also essential for reports to be confidential or de-identified; the reporting process must be user-friendly, and actionable feedback is paramount.
- *Informed Culture* analyzes and shares data from the reports gathered (Reason, 1997). This process informs employees of potential safety concerns and how to handle them properly.
- *Just Culture* provides the cultural underpinning that alleviates employee concerns regarding reporting unsafe acts (Reason, 1997) and balances learning with accountability (Dekker, 2012, p. 7). A no-blame culture is not appropriate since some unsafe acts are intentional and extreme. The New View does not eliminate individual accountability (Baker, 2010; Dekker, 2014). Employees would not trust the system or suitably behave if people are not held culpable for intentional actions (Reason, 1997). Figure 1 shows a decision tree for determining culpability. This decision tree can be used for each of the unsafe acts committed (Reason, 1997, p. 208). A just culture requires clearly defining acceptable and unacceptable behavior (Dekker, 2012, p. 15). It is not practicable to believe that everyone in an organization will embrace the just Culture, although the majority must embrace it, for a just culture to take root and thrive.

- *Flexible Culture* enables the organization to respond to abnormal conditions quickly by passing decision-making authority to front-end employees. Relinquishing decision-making authority takes trust in the employee's skills and abilities and investment in those skills (Reason, 1997, p. 196).
- *Learning culture* is the expectation that the organization can analyze, learn from, and act on its data (Reason, 1997, p. 196).

T/F. The old view of safety looked at human error as the cause of accidents and incidents and safety as the absence of accidents or incidents.

T/F. A manager's support for safety will not influence a subordinate's support for safety.

T/F. Safety Culture is just part of the puzzle when creating a safe organization.

T/F. A just culture requires employers to establish a clear line between acceptable and unacceptable behavior.

T/F. A just culture is also referred to as a “no-blame” culture.

A safety culture goes beyond possessing these five subcultures (Reason, 1997, p. 220). If an organization is going to achieve a successful safety culture, it must genuinely embody these principles and not simply go through the motions. In the lulls between serious safety events, supervisors may feel compelled to sacrifice safety defenses in the interest of other operational concerns (Reason, 1997, p. 5). Decreasing defenses for other concerns is called 'risk compensation' or 'risk homeostasis. These organizational defenses can be 'soft' or 'hard' (Reason, 1997, p. 8). Soft defenses utilize people and paper, such as policies, procedures, regulations, checklists, and briefings (Reason, 1997, p. 8). On the other hand, hard defenses include physical barriers, alerts and annunciations, personal protective equipment, and aircraft engineering.

Where does Culture fit in each of the models from Introduction to Human Factors?	
Model	Culture
Dirty Dozen	
SHELL	
HFACS	

Active Failure

When analyzing an accident, the best place to start is with the unsafe act committed by the operator and work in reverse chronological order (Wiegmann & Shappell, 2003, p. 48). An *unsafe act* is "an error or violation committed in the presence of a potential hazard... that if not properly controlled, could cause injury or damage" (Reason, 1990, p. 206). There are three methods we can use to identify unsafe acts. The first method was previously discussed with accident causation analysis models, the *Human Factors Analysis and Classification System (HFACS)*. The second method is *James Reason's Human Error Types*. If you are analyzing a case study for unsafe acts and previously used the HFACS model, I recommend sticking with it. However, if you used a different model, you should use Reason's Human Error Types to prevent confusion. Since the HFACS model is based on the Swiss Cheese model developed by James Reason, we will use Reason's definitions for the different unsafe acts. For both methods, the term "unsafe act" will be used as an all-encompassing term for errors and violations (Reason, 1990; Wiegmann & Shappell, 2003).

Lastly, we will discuss managing unsafe acts using the Threat and Error Management (TEM) model. TEM includes intentional and unintentional acts as errors and can create confusion between James Reason's definitions and TEM.

Identifying Unsafe Acts

Errors

Errors can be either latent (part of the system, hidden and difficult to identify) or active ("effects are felt almost immediately") (Reason, 1990, p. 173). This discussion will focus on active failures since frontline employees typically commit them. In HFACS, the "Unsafe Acts of Operators" level is the only level that protects against active failures (Wiegmann & Shappell, 2003, p. 48).

James Reason's Error Types. Both errors and violations require intention, meaning you intend to do something, not necessarily you did what you intended (Reason, 1990, p. 195). *Errors* are "actions that deviate from intention" and can be classified as actions that still achieve their intended goal and actions that do not (Reason, 1990, p. 8). James Reason identified three types of errors: *slips*, *lapses*, and *mistakes*.

> Slips and lapses are errors which result from some failure in the execution [slips] and/or storage [lapses] of an action sequence, regardless of whether the plan which guided them was adequate to achieve its objective (Reason, 1990, p. 9).
>
> Mistakes [are] deficiencies or failures in the judgmental and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it, irrespective of whether the actions directed by this decision-scheme run according to plan (Reason, 1990, p. 9).

Slips and lapses can be differentiated from mistakes by looking at the cognitive processes behind each error type (Reason, 1990, p. 8). As previously discussed, errors require the intention to act. Mistakes occur at the planning stage of that intention, lapses occur at the storage stage of the plan, and slips occur during the execution of the plan (Reason, 1990, p. 13).

The three types of errors can be analyzed using three questions (Reason, 1990, p. 5):

1. Were the actions directed by some prior intention?
2. Did the actions proceed as planned?
3. Did they achieve their desired end?

T/F. James Reason's errors are categorized according to the cognitive process involved in achieving the goal of the action.

T/F. According to James Reason, errors are not intentional; however, the original planned action must be intentional.

Make connections between at least one of the models from Introduction to Human Factors and James Reason's Error types. (Think what can lead to each error type)

James Reason's Error Types	Connection
Slips	
Lapses	
Mistakes	

HFACS Errors. As previously discussed, Wiegmann and Shappell (2003) identified three subcategories of errors: skill-based, decision errors, and perception errors.

- *Skill-based errors* are basic skills that occur instinctually since the skills have been practiced or repeated to the point that they are automatic (Wiegmann & Shappell, 2003, p. 51).
    - *Attention errors* are skill-based errors characterized by fixation, distraction, or other types of inattention (Wiegmann & Shappell, 2003, p. 51).
    - *Memory Errors* are skill-based errors characterized by "omitted items in a checklist, place losing, or forgotten intentions" (Wiegmann & Shappell, 2003, p. 52).
    - *Technique errors* are skill-based errors that occur because of **how** we complete a task (Wiegmann & Shappell, 2003, p. 53).

- *Decision errors* - lack of knowledge or poor planning results in a plan of action that proceeds as planned but does not accomplish the goal (Wiegmann & Shappell, 2003, p. 53).
    - *Procedural errors* are decision errors that take place during procedural tasks, and the wrong procedure or "production rule" is applied because the condition is either unrecognized or misdiagnosed (Wiegmann & Shappell, 2003, p. 53).
    - *Choice Decision errors* occur when "insufficient experience, time, or other outside pressures "prevent operators from developing viable choices and they do not make the best choice (Wiegmann & Shappell, 2003, p. 53).

T/F. HFACS and Reason use the same classifications for errors.

T/F. Practically speaking, it is better to know the types of errors than how to detect and manage them.

T/F. Errors and violations are limited to incidents and accidents.

T/F. Based on the HFACS model, the subcategories of errors are skill-based, decision, and routine.

Make connections between James Reason's Error types and HFACS errors.

James Reason's Error Types	HFACS Errors
Slips	
Lapses	
Mistakes	

Make connections between HFACS Errors and either SHELL or Dirty Dozen from Introduction to Human Factors. (Think "what can lead to each error type?")

HFACS Errors	Connection
Slips	
Lapses	
Mistakes	

- *Perception errors* - results from errors in our perception (I am sure that cleared it up nicely) (Wiegmann & Shappell, 2003, p. 54). These errors can be caused by spatial or visual disorientation or when our perception does not match reality. We will explore perception more when we discuss Information Processing.

Performance Levels. *Rasmussen's Performance Levels* organize error types based on whether the person is or is not using critical thinking or problem-solving (Reason, 1990, p. 56). Rasmussen divided human performance into three levels: skill-based, rule-based, and knowledge-based (Reason, 1990, p. 43).

- *Skill-based Performance Level* - performance is automatic through a series of "pre-programmed instructions" (Reason, 1990, p. 43). It becomes automatic if the action is practiced enough or done often enough. Tasks we complete at the skill-based level are known and can be prepared for (Reason, 1990, p. 60).
- *Rule-based Performance Level* - performance follows production rules, which are a series of stored rules that come in the form of "if (state) then (diagnosis) or if (state) then (remedial action)" (Reason, 1990, p. 43). This level of performance requires more cognitive work than skill-based performance, but these production rules pertain to planned or expected situations.

- *Knowledge-based Performance Level* is performance in new situations. This level requires more cognitive work and problem-solving skills (Reason, 1990, p. 43). People must develop a new method of dealing with a situation they have not been trained for, and these tasks were previously unknown.

Considering that a large part of our daily decisions are completed at the skill-based level, more errors will also occur at this level (Reason, 1990, p. 58-59). As our knowledge and experience increase, we perform more at the skill-based level since we no longer find ourselves in as many situations that require the knowledge-based level (Reason, 1990, p. 58). Therefore, experienced professionals are likely to commit more errors at the skill and rule-based levels simply because more of their decisions are made at those levels than inexperienced professionals, who must make more decisions at the knowledge-based level.

Table 4-14
Performance Levels and Error Types. Created from Reason, 1990, p. 56 and Wiegmann & Shappell, 2003, p. 51-53.

Performance Level	Error Type	
	Reason's Error Types	HFACS
SB	Slips and Lapses	Skill-based Errors
RB	Mistakes	Decision Errors
KB	Mistakes	Choice Errors

As we can see from the table above, Reason has indicated that mistakes can be committed at the rule-based or knowledge-based level. So, how do you know the difference between a rule-based and a knowledge-based mistake?

Remember, mistakes occur in the planning stage. Therefore, you can commit a *rule-based mistake* if you apply a bad rule or you misapply a good rule to the situation. People tend to want to use the least amount of cognitive effort when completing a task, so they tend to resort to

the rule-based level before attempting the knowledge-based level (Reason, 1990, p. 75). Typically, people use a rule they have used successfully, even if it does not entirely match the current situation (Reason, 1990, p. 75). Applying a good rule to a situation that it does not entirely match would be the **misapplication of a good rule**. If someone does not fully understand the situation or the rule they are applying or the action has negative results, that is the **application of a bad rule** (Reason, 1990, p. 79).

When the wrong rule is applied (misapplication of a good rule), there are typically three indications (Reason, 1990, p. 76):

1. Signs that the current situation matches the chosen production rule.
2. Countersigns that the situation does not match the chosen production rule.
3. Non-signs do not match the chosen production rule, nor do they match any other production rule.

A *knowledge-based mistake* occurs if the decision-maker lacks the situational awareness to accurately diagnose and correct the situation (Reason, 1990, p. 86). Knowledge-based mistakes may sound familiar to rule-based mistakes, but remember, the knowledge-based performance level requires the decision maker to devise a way of dealing with a situation they have not been trained for, which means there is no ready-made production rule to handle the situation.

T/F. The Knowledge-Based performance level requires more cognitive work than the rule-based level.

T/F. Slips and lapses occur at the knowledge-based level of performance.

T/F. Errors that are execution failures occur at the rule-based level of performance.

T/F. Mistakes can occur at both the skill-based and the rule-based performance levels.

T/F. If the wrong production rule is applied (rule-based mistake), there are typically countersigns that the situation does not meet the chosen production rule.

T/F. According to James Reason, more errors will occur at the knowledge-based level.

Violations

Reason and Wiegmann and Shappell use the same types of violations. *Violations* are acts that intentionally do not follow established policies, procedures, rules, or regulations but **do not** intend to cause harm (Reason, 1990, p. 195).

- *Routine Violations* occur when we 'routinely' violate SOPs (standard operating procedures). These violations occur for two reasons: humans want to 'do better' and think the established procedures are inefficient (Reason, 1990, p. 196). Remember from the discussion on discipline that once you violate a policy or procedure, which becomes the new norm. After a time, a routine violation becomes a habit, and we often get "approval" to continue doing them because the authority responsible for correcting this behavior either fails to correct it or knowingly allows it (Reason, 1990, p. 196; Wiegmann & Shappell, 2003, p. 55).
- *Exceptional violations* are "exceptions to the rule." These violations are atypical for the operator and the organization (Reason, 1990, p. 196; Wiegmann & Shappell, 2003, p. 55). These

T/F. For an act to be a violation, the actor must know that the action would have negative consequences.

T/F. A culture where violations are neither necessary nor accepted should be established to mitigate violations.

T/F. Based on the HFACS model, the subcategories of violations are routine, exceptional, and perceptual.

violations commonly occur when the resources necessary to complete the task successfully are unavailable.

Threat and Error Management

Threat and Error Management (TEM) was initially developed to provide a simplified viewpoint of commercial aviation flight operations but can be used to analyze human error in other situations (FAA, 2006).

TEM has three main components: threats, errors, and undesired aircraft states (FAA, 2006). *Threats* are outside the control of the frontline employee and can be associated with the environment, either physical environment, such as weather or airport layout, or operational environment stemming from issues within the organization. Threats may be anticipated or unexpected. Anticipated threats can be pre-briefed and quickly resolved, but unexpected threats may take considerable time and effort. Mismanagement of a threat can led to errors.

As previously stated, TEM errors differ from James Reason's definition of errors. *TEM Errors* include both intentional and unintentional acts. These errors may be classified as handling, procedural, and communication errors (FAA, 2006). It is more important for professionals to know how to manage errors than it is for them to be able to identify the type of error or violation correctly.

Undesired Aircraft States (UAS) may result from a poorly managed error (FAA, 2006). UAS directly result from the flight crews' actions and compromise safety such as "unstable approaches, lateral deviations, firm landings" (FAA, 2006, Appendix 1 p. 2).

Countermeasures can prevent threats from causing errors and developing into undesired aircraft states (FAA, 2006). These countermeasures can be crew behaviors, technology, procedures, or any mix. Crew behavior countermeasures include planning (i.e., contingency

management and briefings), execution (i.e., monitoring/cross-checking and workload management), and review/modify (evaluation of plans and inquiry) countermeasures. Technology countermeasures may be warning systems and weather alerts. Procedural countermeasures include checklists and standard operating procedures.

Even though the TEM conversation has centered around the flight crew and the aircraft, the concept can be applied to any aviation (or life) situation. Threats are factors outside your control that can lead to errors if not effectively managed. Errors are within your control that, if not effectively managed, can lead to undesired aircraft states, which may result in incidents or accidents.

T/F. TEM only concentrates on the operational aspects and does not evaluate the human.

T/F. Threats can be expected, unexpected, or hidden.

Which aspect(s) of the models from Introduction to Human Factors would you consider a threat?

Model	Threat
Dirty Dozen	
SHELL	
HFACS	

Managing Unsafe Acts

So far, we have discussed how to identify unsafe acts; now, it is essential to cover how to manage them. Error management seeks to reduce and contain errors (Reason, 1997). According to James Reason (1997), error management includes:

- Measures to minimize the error liability of the individual or team.

- Measures to minimize the error vulnerability of particular tasks or task elements.
- Measures to discover, assess, and then eliminate error-producing and-violation producing factors within the workplace.
- Measures to diagnose organizational factors that create error-producing factors within the individual, the team, the task, or the workplace.
- Measures to enhance error detection measures to increase the error tolerance of the workplace or system.
- Measures to make latent conditions more visible to those who operate and manage the system.
- Measures to improve the organization's intrinsic resistance to human fallibility. p. 125

Measures to manage unsafe acts, sometimes referred to as barriers, controls, or defenses, should not be aimed at the previous act but should focus on preventing the next one (Reason, 1997, p. 126). Barriers can be designed to stop a dangerous event from occurring, deflect, or minimize its effects; they can also be passive or active and temporary or permanent (Hollnagel, 2004). According to Bauer (2006, as cited in Stolzer, Sumwait, and Goglia, 2023), the most effective measure is to eliminate the hazard. However, human error cannot be completely eliminated. Therefore, the remaining options are to reduce the hazard level, and provide safety devices, warnings or advisories, and safety procedures (Bauer, 2006, as cited in Stolzer, Sumwait, and Goglia, 2023). Reducing the hazard level requires reducing the likelihood or severity of the hazard occurring. This can be done through education, or what you are doing right now by studying human factors. Safety devices and warnings or advisories are numerous and fall more under the design of the workspace therefore we will focus on safety procedures here.

Policies and procedures are the least effective defense since they do require the individual to follow them; however, for that same reason, they are more susceptible to human factors. Safety procedures must balance minimizing unsafe acts with providing sufficient flexibility for operators to react to novel situations that do not have a procedure (Strauch, 2017, p. 115).

Safety procedures, commonly called standard operating procedures (SOPs), are passive and mostly permanent in aviation but can be temporary. Following safety procedures can prevent adverse events by specifying how to complete a task, such as a normal engine starting safely. However, it can also minimize the effect of a dangerous event, such as a procedure for an electrical fire.

In designing any barrier against human error, the designer must consider the Law of Unintended Consequences (Merton, 1979 as cited in Hollnagel, 2004, p. 17), which warns against unintentionally introducing new hazards into the system while addressing other hazards. Procedural drift can occur when there is a difference in how the people who write the procedures expect the system to work and the way the system works (Dekker, 2014, p. 110). Therefore, someone familiar with the process should be involved in the procedure writing, and procedures should be updated when differences between reality and the procedure are identified. Always remember that the person using the procedure will always be doing at least two things: reading and completing the procedure (Wieringa et al., 1998, p. 11). Suppose the procedure and other stressors exceed the person's cognitive resources. In that case, they may choose to give up on the procedure, focus more on the procedure than completing the task, or complete the task without understanding the procedure (Wieringa et al., 1998, p. 14). Review the FAA advisory circular 120-17 Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers for guidance on writing procedures.

Make connections between Unsafe Acts and the Airmanship Model.

HFACS or James Reason Error Types	Specific Unsafe Acts	Airmanship Model Connection

Conclusion

Managing unsafe acts such as errors and violations first starts with choosing a taxonomy to classify them. Unsafe acts can be identified through reporting systems, which makes a positive safety culture imperative, or through accident or incident investigations. Identifying and tracking unsafe acts makes it possible to develop management strategies. Management strategies can take many forms but must be aimed at the future, not the past, meaning they should focus on preventing the next unsafe act, not just reacting.

Analyze the following information from the NTSB report on Colgan 3407.

According to the NTSB (2010),

> About 2216:09, the low-speed cue began to rise from the bottom of the airspeed display as the airspeed slowed. However, the flight crew made no remarks and took no actions that were consistent with the recognition of this cue. Also, because the autopilot altitude hold mode was engaged when the airplane leveled off at 2,300 feet, the autopilot continued to add nose-up pitch trim to maintain altitude as the airspeed slowed. During the time that the low-speed cue was in view, the airplane's pitch trim increased from 1° to 7° nose up, and the pitch attitude of the airplane increased from

> 3° to 9° nose up. Neither pilot remarked about the increasing pitch attitude, even though it was a cue indicating that airspeed was slowing. In addition, the numbers on the airplane's IAS [indicated airspeed] display changed from white to red as the airplane reached the calculated stick shaker activation speed. About 2216:27, the stick shaker activated at an airspeed of 131 knots, which was 13 knots higher than the Vref [reference speed] that the flight crew had set but 7 knots lower than the Vref icing speed. (p. 84)

The NTSB determined there was sufficient time for the crew to observe the airspeed indications. However, neither crew member reacted to the information (NTSB, 2010, p. 84). The investigators could not establish why the captain did not react to the airspeed indicator; however, the first officer's duties could have decreased her chances of seeing the indications. Based on the crew members' training, both had knowledge of the aircraft's ice protection system. The manufacturer's airplane flight manual warned of a stall potential if the ref speeds switch was in the increase position and airspeed was not increased (NTSB, 2010, p. 85). The flight crew did not acknowledge the position of the ref switch either during their checklist or the alert on the engine display. "[If] the ref speeds switch had been turned to the off position after stick shaker activation, the shaker would have stopped. As a result, the NTSB concludes that the flight crew did not consider the position of the ref speeds switch when the stick shaker activated."

In 2006, the FAA issued a Safety Alert for Operators to emphasize sterile cockpit rules and that non-compliance with this regulation contributed to a recent accident (NTSB, 2010, p. 57). "[Colgan] Check airmen stated that, during check rides, captains were expected to brief

sterile cockpit procedures before the flight, and the procedures were expected to be followed during the flight." (NTSB, 2010, p. 45). As the Colgan 3407 flight crew descended below 10,000 feet (approximately 2206:37), the crew participated in non-pertinent conversation off and on until after they had completed the descent and approach checklists (about 9 minutes later) (NTSB, 2010, p. 92).

Concept	What concept(s) is/are present?	Evidence (explain why)
James Reason's Error(s)		
HFACS Error(s)		
Violation(s)		
Threat and Error Management		

Key Term Index

KLM Flight 4805 and Pan Am 1736 at Tenerife Unsafe Acts Analysis

The number one unsafe act committed at Tenerife was the Royal Dutch Airlines (KLM) captain's attempt to take off without a clearance. At first, this act was a *lapse*, a memory error, committed at the *skill-based (SB) level* ("Human Error Types," 2016). The SB level of performance is "preprogrammed and automatic"; the captain should not have had to think about the need for a takeoff clearance (Moriarty, 2003, p. 79). According to Reason, lapses occur during the stage of plan expectation, and the captain incorrectly stores the sequence of actions necessary for takeoff (Reason, 1990). In this case, the captain forgot to obtain a takeoff clearance, and the first officer trapped the error by stating, "Wait a minute, we do not have an ATC clearance." (Stamford Krause, 2003, p. 204).

The captain then committed an *exceptional violation* by intentionally re-starting the takeoff roll before the first officer obtained the clearance (Reason, 1990, p. 196; Stamford Krause, 2003, p. 204). Exceptional violations are considered atypical behavior for the operator and the organization, and taking off without clearance is not the norm in the commercial aviation environment (Reason, 1990, p. 196; Wiegmann & Shappell, 2003, p. 55). The crew had plenty of time, and the poor weather should have encouraged close adherence to safety procedures, such as receiving a departure clearance before starting the takeoff roll.

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5 – 4 – 3 – 2 – 1 Review

Purpose

This activity introduces students to five different metacognitive exercises for reviewing the reading. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Define at least 5 Key terms/Concepts from the reading.
2. Create at least 4 practice 'test' questions.
3. Imagine you are talking to someone about at least three conepts you learned from this reading. Explain those concepts in enough detail so that someone unfamiliar with the concepts can understand them.
4. Imagine you are talking to someone about two concepts you found interesting from the reading that you want to learn more about. Explain those two things in enough detail so that someone unfamiliar with the concepts can understand them. Include a reference to a source that explains the concept beyond what was covered in the reading.
5. Identify at least one topic/concept you did not understand from the reading and ask the instructor a question.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.

- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Include page numbers from the reading for each task.
- If including abbreviations in task #1, they must be explained/defined beyond simply spelling out the abbreviation.
- For task #2 do not include more than 2 true/false questions and do not repeat the questions included in the reading.
- Your explanations for tasks #3 and #4 must be at least 50 words. Meeting the word count may not ensure you have sufficient detail to explain the concept to someone who isn't familiar with the topic.

The Key terms: are Defined Correctly are In Full and Complete Sentences include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Practice Test Questions: are Unambiguous and Correct include Appropriate Question Types include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Topics Learned: are Clear and Correctly Explained are in Full and Complete Sentences in Sufficient Detail include Page Numbers	No errors	1-2 Errors	More than 2 errors
The Interesting Topics: are Clear and Correctly Explained are in Full and Complete Sentences include Sufficient Detail include Page Numbers	No errors	1-2 Errors	More than 2 errors
The question for the instructor is: Clear in Full and Complete Sentences	No errors	[redacted]	1-2 Errors

includes a Page Number Related to the module topics			
The included topics show full coverage of the material.	One of the following is acceptable: - Two topics were duplicated. - One topic was included in 3 task sections		One or more of the following: - Three or more topics were duplicated. - One topic was included in more than 3 areas - One task section was entirely incomplete. - 2 task sections were partially incomplete.
Blacked out performance criteria means that criterion is not applicable to that content area.			

Learning Log

Purpose

This activity provides the opportunity to reflect on the reading to demonstrate your understanding. These exercises should be included in your notes and used for studying. Including page numbers can help while you study.

These questions are adapted from Fernald (2004) as cited in Carney, A.G., Fry, S.W. Gabriele, R.V. & Ballard, M. (2008). Reeling in the big fish: Changing pedagogy to encourage the completion of reading assignments. *College Teaching, 56*(4). 195-200. https://doi.org/10.3200/CTCH.56.4.195-200

Tasks

3. Answer the following questions:
    a. Describe the major thesis, the central idea or set of ideas, in the reading. Also include one or two closely related ancillary or secondary ideas or theses, clearly identifying them as such.
    b. Identify *two concepts or principles* presented in the chapter or article and, when you first mention each, italicize it and define it. Then, show how the concepts or principles in some way(s) are both similar to and different from one another. If you wish, one of the concepts or principles may be selected from another reading, lecture, or discussion in this course.
    c. Select a *concept or principle* in the chapter or article, italicize it, clearly define or describe it, and then indicate how it applies to you or someone you know. Provide sufficient details to justify convincingly that the concepts or principle indeed applies as you suggest.

d. Write a critical perspective on some aspect of the chapter or article, citing evidence that prompts you to agree or disagree with the author's perspective. Note that a critique may be positive, negative, or some combination of both. Your evidence may be based on (1) personal experience, (2) observations of others, (3) reports of others, (4) scientific findings, or (5) logic. When citing evidence, identify the type(s) of evidence you are using.

e. Citing page number(s), quote verbatim a statement or brief passage that elicits in you some type of emotional response: excitement, frustration, pleasure, anger, sadness, surprise, confusion, fear, delight, some combination of the aforementioned, or whatever. Then identify your emotional response, describe the meaning(s) that the statement or passage has for you, and provide actual or possible reasons for your response.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Complete all 5 learning log prompts.
- Even if this assignment is typed, a hardcopy counts as "handwritten notes", remember the page count still applies for the test.

- You are allowed to cover the same topics in multiple tasks, but the full range of tasks should show your full coverage and understanding of the module reading.
- Each prompt is worth 4 points:
    - 2 points for accuracy (where appropriate), clarity, and detail (your answers should be at least 100 words).
    - 1 point for complete sentences with correct grammar and spelling.
    - 1 point for a topic sentence and page number(s).

True/False Questions

Purpose

The purpose of this assignment is to review the True/False questions included throughout the reading and provide an answer to those questions. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Review the True/False questions in the reading (shown in purple boxes).
2. Answer whether the question is True or False.
3. If the answer is false, rewrite the statement as a true statement.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- 5 Points – Each statement includes page numbers from the reading.
- 1 Point for each correctly identified true statement.
- 1 Point for each false statement rewritten as a true statement.
    - Some statements can be rewritten in multiple ways; please include all true statements.

- Each statement must be a complete sentence with correct grammar and spelling. Points will not be assigned for statements with grammar or spelling mistakes that change the meaning of the statement or make understanding the statement difficult.
- You cannot just add or remove the word “not” (or an equivalent basic change to the statement). If the statement can be changed to a true statement by adding or removing “not,” you must also include why that statement is true (i.e., “not…because”).

Make Connections

Purpose

The purpose of this assignment is to review the green "Make Connections" boxes included throughout the reading and provide an answer to those prompts. Remember, the connections may not be "synonymous" but may be opposite terms or any other type of relationship. The answers should be included in your notes and used for studying. Including page numbers can help while you study.

Tasks

1. Review the "Make Connections" prompts in the reading (shown in green boxes).
2. Answer the prompt and provide evidence to explain why you made that connection. The evidence should not be a simple definition of each concept, but instead, explain in your own words based on the concept's meaning why you think they are connected.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Each connection is worth 2 points:
    - 1 point – Connection is logical and explained in detail. Explanation must be at least 50 words. Meeting the word count may not ensure you have sufficient detail

to explain the concept.

- .5 points – Includes page numbers from the reading.
- .5 points – Explanation is in complete sentences with correct grammar and spelling.

Study Questions

Purpose

This assignment aims to help you identify some (not all) key human factors concepts from the reading. Your answers should be included in your notes for studying.

Tasks

- Complete the reading and answer the following questions.
    1. Which level of performance requires the most cognitive work?
    2. The ability to unconsciously tie your shoes is an example of what performance level?
    3. Unintentionally selecting the wrong switch is an example of what type of error?
    4. Forgetting a checklist item is an example of what type of error?
    5. Slips and lapses occur at what level(s) of performance?
    6. If the plan we have decided on is wrong, that is an error at what level(s) of performance?
    7. Based on the HFACS model, which is not a subcategory of error?
        a. Routine Error
        b. Skill Based Error
        c. Decision Error
        d. Perceptual Error
    8. Based on the HFACS model and James Reasons Human Error Types, which is not a subcategory of violation?
        a. Decision Violation
        b. Routine Violation
        c. Exceptional Violation

d. Perceptual Violation

9. Identify the components of TEM.
10. The brain's ability to perform some tasks with minimal attention can lead to:
    a. Slips
    b. Lapses
    c. Violations
11. Effective violation management focuses on:
    a. the root cause.
    b. the perpetrator.
12. Which performance level most accurately corresponds to "critical thinking"?
13. Errors that are execution failures occur at what level(s) of performance?
14. Errors that are planning failures occur at what level(s) of performance?

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Each question is worth 2 points:
  - 1 point – Each answer is accurate and clear.

- .5 point – Each answer is rewritten as a definitive statement that restates the question and is in complete sentences with correct grammar and spelling.
- .5 point – Each statement includes page numbers from the reading.

Peanut Butter and Jelly Standard Operating Procedure

Purpose

The purpose of this assignment is to apply knowledge of unsafe acts to writing a Standard Operating Procedure (SOP). SOPs have a significant impact on safety. Following SOPs takes discipline and airmanship, but SOPs are an effective mitigation strategy for unsafe acts. The purpose of this assignment is to practice developing a procedure for a common task and utilizing feedback to mitigate unsafe acts.

Materials and Technology Needed:

- Electronic Device with internet access
- FAA AC-120-17 Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers (Chapters 4&5)
- Materials to create a Peanut Butter Sandwich, another type of simple sandwich, or a simple household task.
- Video Recording device (cell phone videos are acceptable, but you may have to change the file format).

Tasks

- **Part A: Original SOP**
    1. Read the FAA AC-120-17.
    2. Develop a "Standard Operating Procedure" for making a peanut butter and jelly sandwich.
        - Note: If you do not eat peanut butter and jelly sandwiches for any reason (i.e. allergies, do not have the materials), please write your SOP making your favorite (simple) sandwich.

- If you do not have the materials to make any sandwich, please choose any "simple" household task.
- Feel free to email the instructor to check if your idea/topic is acceptable or for ideas.

- **Part B: Video**
  1. Record a friend following your procedure.
     - Remember they need to follow the instructions; they should only deviate when absolutely necessary. *Note the type of Unsafe Acts for Part C.
- **Part C: Corrected SOP with Unsafe Act Analysis**
  1. Identify if you will use HFACS or James Reason's Human Error Types to analyze your unsafe acts.
  2. Explain at least one area where your friend could have committed an *error*. Define the type of error and explain at which performance level you think it would be committed.
  3. Explain at least one area where your friend could have committed a *violation*. Define the type of violation.
  4. Using the TEM model identify one *threat* that led to or could have led to an *error* and the *Undesired Aircraft State (UAS)* that developed or could have developed. Define threat, error, and undesired aircraft state.
  5. Make corrections to your SOP to mitigate any unsafe acts.
- Submit Parts A, B, and C at the same time. Part A and C may be in the same file or separate files.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- This assignment asks you to identify (in italics) and explain/define from the reading. This explanation can be a direct quote from the reading or a summary/paraphrase.
- Each Part is graded as follows:
    - **Part A**
        - 1 Point – SOP consists of 5-10 Points.
        - 1 Points – Draft SOP shows sufficient guidance so that the reviewer did not "have to" deviate.
    - **Part B (points can only be assigned if full credit for Part A is earned)**
        - 1 Points – Video is reviewed by someone other than the student.
    - **Part C (points can only be assigned if full credit for Part A and B is earned)**
        - 3 Points – Error, Violation, and TEM Components are identified, defined/explained and included a page number from the reading.
        - 1 point – Unsafe Act Analysis contains complete sentences with correct grammar and spelling.
        - 1 point – Unsafe Act Analysis contains paragraph topic sentences and page number(s).

- 2 Points – Corrected SOP mitigates the identified unsafe acts.

Unsafe Acts Graphic

Purpose

Having trouble differentiating between the types of Unsafe Acts? This assignment will provide you with the opportunity to develop a graphic that helps you learn the differences between Unsafe Acts.

Tasks

1. Create a graphic (such as a concept map or decision tree) that shows the reader how to distinguish between all the types of Unsafe Acts; James Reason's Error Types, HFACS Unsafe Acts, and TEM components.
2. Submit your complete graphic.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).
- This is an individual assignment; students should not have the same answers as a peer.
- Your graphic must be engaging and informative. It must allow the viewer/reader to understand the differences between the types of Unsafe Acts (not simply provide a definition/explanation).
- The graphic must be legible, you can hand draw the submission if you choose, but if it isn't legible, it will be assigned a zero.

- The graphic is worth 10 points:
    - 5 Points – The graphic demonstrates a deeper understanding of all of the types of unsafe acts.
    - 3 Points – The graphic clearly demonstrates the differences/similarities between all of the types of unsafe acts.
    - 2 Points – The graphic is easy to understand and is engaging.

Discussion Questions

Purpose

This activity will give you the opportunity to prepare for a class discussion. The questions aim to help you start thinking critically about human factors concepts from the reading. Your answers should be included in your notes for studying. Including page numbers can help while you study.

Tasks

- **Before class, complete the reading and answer the following discussion preparation notes:**
    1. Explain the different views on safety and human error and their relationship with safety culture (include all subcultures).
    2. Choose either Reason's errors or HFACS errors and explain how airmanship can prevent each specific type of error.
    3. Choose either Reason's errors or HFACS errors and provide one real-world example for each specific error.
    4. Connect each specific type of HFACS error to James Reason's Error Types. Explain your reasoning.
    5. How can airmanship prevent each type of violations?
    6. Make at least three connections between James Reason's Error Types (including violations) and one accident causation model from Introduction to Human Factors. At least two of those connections must include key terms from both topics. Remember to explain/define the key terms and explain the connections.
    7. Provide one real-world example for each violation.

8. Explain the differences and similarities between TEM Errors and either HFACS or James Reason's Error Types.
9. Choose one of the real-world examples of errors or violations you identified before. Using the TEM model, identify the threat that if mismanaged could lead to the TEM error and what kind of undesired aircraft state that could arise if the error is mismanaged. Describe how each component could be effectively managed or mismanaged. **Keep in mind that the undesired aircraft state can be any undesired situation that can have a negative outcome, not necessarily related to an airplane.
10. Make at least three connections between James Reason's Error Types and one accident causation model from Introduction to Human Factors.
11. In your own words discuss how standard operating procedures can be used to manage unsafe acts without devolving to the Old View of human error.

- **In-Class you must actively participate in the discussion.**
  1. Bring a copy of your notes.
  2. Discuss your answers with your group.
  3. Share your answers with the class.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This assignment does not require APA citations or Student Title Page since you are not required to use a source other than the reading. If you use a source other than the reading, remember to include the citations (a title page is still not required).

- This is an individual assignment; students should not have the same answers as a peer.
- **Discussion Preparation Notes:**
    - Can be typed or handwritten (must be legible, if it can't be read, it can't be graded).
    - In-text citations and end-of-text references are only required if you use a source other than this reading.
    - Do not forget your page numbers for each question.
- **In-Class Discussion:**
    - You must have a copy of your discussion preparation notes to actively participate in the discussion.
    - You must be present in class for the full activity to earn credit for the discussion

	Yes	Developing	No
Were the Discussion Preparation Notes submitted on time, complete, and accurate?	All of the following: - Complete Notes were submitted on time before the in-class discussion. - Notes were legible, accurate, and complete. - Notes include the page number for all question		One of the following: - File was not submitted on time. - Submission was not legible and could not be graded. - Submission did not include the page number for 2 or more questions. - 2 or more of the questions were not completed, partially incomplete, or were not correct.
Was the student an active participant in the Group Discussion?	All of the following: - The student acts professionally, stays on topic, and manages their time well. - Students was able to contribute to the discussion beyond the assigned questions by asking questions and answering peer questions. - Student was prepared for the group discussion by submitting their Discussion Preparation Notes on time and bringing a hard copy to class.	Student actively participated in the discussion but was not prepared (one of the following): - Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a copy of the notes to class.	One of the following: - Student did not participate in the discussion. - Student was not present for the whole discussion. - Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class.
Was the student an Active participate in the Class Discussion?	All of the following: - The student acts professionally, stays on topic, and manages their time well.	Student actively participated in the discussion but was not prepared (one of the following):	One of the following: - Student did not participate in the discussion. - Student was not present for the whole discussion.

	- Student was prepared for the group discussion by submitting their Discussion Preparation Notes on time and bringing a copy to class. - The student was able to successfully articulate their thoughts to the class and answer appropriate follow-up questions.	- Complete and legible Discussion Preparation Notes were not submitted. - Student did not bring a hard copy of the notes to class.	- Student did not submit complete and legible discussion preparation notes and did not bring a hard copy of the notes to class
Blacked out performance criteria means that criterion is not applicable to that content area.			

Small Group Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

1. Complete the discussion preparation notes.
2. Attend class for the scheduled module discussion and actively participate in the group discussion.
3. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and group discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on the question a peer asked you during the discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the group discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked a peer during the discussion.
    i. What did you ask?
    ii. Why did you ask this question?
    iii. What was the answer?
    iv. Did the answer help you better understand the concept, the question, your peer, or something else?
e. Briefly reflect on your preparation for the in-class discussion.
    i. Did you complete the preparation notes?
    ii. How seriously did you take the completion of the preparation notes?
    iii. Did you put aside sufficient time to complete the notes without stressing?
    iv. Did you bring a copy of the preparation notes to class?
    v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Class Discussion Reflection

Purpose

The activity will provide you with the opportunity to reflect on your participation and learning from the in-class discussion.

Tasks

2. Complete the discussion preparation notes.
3. Attend class for the scheduled module discussion and actively participate in the class discussion.
4. Reflect on your participation and learning by completing the following questions.
    a. Briefly reflect on if or how this activity (discussion preparation notes and class discussion) positively aided your learning.
        i. Did the discussion help you better understand the module concepts?
        ii. Did the discussion change the way you think about the module concepts?
        iii. Do you still have any outstanding questions?
    b. Briefly reflect on a question a peer asked during the class discussion.
        i. What was asked?
        ii. What was the answer?
        iii. Did the question/answer help you better understand the concept, your peer, or something else?
    c. Briefly reflect on your participation in the class discussion.
        i. What was your level of participation compared to your peers?
        ii. Should you participate more or less? Why?
        iii. Other thoughts.

d. Briefly reflect on the question you asked during the discussion.
    i. What did you ask?
    ii. Why did you ask this question?
    iii. What was the answer?
    iv. Did the answer help you better understand the concept, the question, or something else?
e. Briefly reflect on your preparation for the in-class discussion.
    i. Did you complete the preparation notes?
    ii. How seriously did you take the completion of the preparation notes?
    iii. Did you put aside sufficient time to complete the notes without stressing?
    iv. Did you bring a copy of the preparation notes to class?
    v. Were you adequately prepared? If not, what could have helped you be more prepared? If you think a change in the homework assignment is necessary, please email the instructor separately as well.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- Students who do not attend the class for the discussion or do not complete this assignment, will be assigned a zero (0).
- You are expected to complete the discussion preparation notes and bring a copy of the notes to class to actively participate in the discussion.

- You are expected to actively engage your group members in discussion by asking and answering questions (beyond just the prepared questions).
- The essay questions are more for your reflection and are graded on completion. The instructor will periodically review some essay answers, but if you have any questions or anything you want to bring to the instructor's attention, please email them directly.
- Your answers should demonstrate a dedication to reflection and lifelong learning, if your answers are not conducive to self-improvement the instructor may leave feedback to encourage more effort toward this end. Subsequent assignments may lose points for the reflection questions if more effort is not made.

Analysis Practice

Purpose

This is a scaffolding/formative assignment that supports the Final Case Study Evaluation Paper.

In this activity you will practice identifying the human factors present in the case study and deconstructing the factor to support your analysis. Students will apply academic integrity procedures to support their viewpoint by including APA formatting requirements such as in-text citations, and references to prepare for the Case Study Evaluation paper.

Objectives

Through this assignment you will **practice** the objectives to 1) Evaluate aviation safety and the impact of human factors on safety, 2) communicate effectively, using written communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses...

Tasks

1. Review the "Analysis Practice" prompts in the reading (shown in orange boxes).
2. Completing an analysis of the human factors in the assigned case study.
    a. Identify the specific human factor present in the case study.
    b. Provide reading evidence in the form of a definition/explanation and citation of the human factor you identified.
    c. Include case study evidence in the form of a finding from the case study with a citation to support why you think that human factor was present.

3. Write your answers in a paragraph with complete sentences. Include a topic sentence that introduces the main idea and a concluding sentence that summarizes the main idea.
4. Share your answers with a class peer using a method where you can collaborate asynchronously and see updates as they happen.
5. Review the "Criteria for Success" for this assignment and provide feedback to your peer.
    a. At least one thing you learned.
    b. At least two areas for improvement.
    c. At least three strengths.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- The KLM Flight 4805 and Pan Am 1736 at Tenerife Analysis provides an example.
- This is a scaffolding assignment for the Case Study Evaluation Paper therefore the Criteria for Success are similar.
- This is an individual assignment; students should not have the same answers as a peer.
- **Practice Analysis:**
    - Your answers must be in paragraph form (including a topic sentence) with correct grammar, sentence structure, and spelling.
    - The key terms/concepts you identify in your analysis must demonstrate a deeper understanding of human factors concepts, therefore the term/concepts you identify in italics must be specific such as "decision error" and not just

"error". But you can still define/explain the term "error" to help your audience gain a better understanding.

- Specific human factors key terms/concepts must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and correctly cited. Italics help draw the reader's attention to those terms and their explanations. Paraphrased definitions/explanations demonstrate your understanding of the concepts. Citations show where you retrieved the information and provide evidence of why your analysis should be trusted.
- Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis and evaluation for your audience.

- **Asynchronous Collaboration**
  - Make sure not to rely on your knowledge of the topic, your peer needs to clearly explain all concepts and acronyms.
  - Your answers must be in paragraph form with complete sentences with correct grammar and spelling.
  - Feedback must refer to a specific example from the peer's paper.
  - Feedback must focus on assignment requirements and not just personal opinions.

	Yes	Developing	No
Are the APA In-text Citations and End of Text References formatted correctly?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Is the paragraph organization logical and does it add to the understanding of the topic and assignment purpose?	Paragraph organization is logical and includes a topic sentence and concluding sentence.		
Are the Mechanics (grammar, sentence structure, and spelling) formatted correctly?	All of the following: - All acronyms are formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation Administration (FAA)). - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included to support the analysis?	The required number of key terms/concepts were identified, defined/explained, and cited.	One of the following: - 75% of the required key terms/concepts were identified, defined/explained, and cited. - The required number of key terms/concepts from the case study were identified,	

		defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the identification of the human factor key terms/concepts.	One of the following: - Cited findings from the case study are used incorrectly to support the identification of the human factor key terms/concepts. - Findings were interpreted incorrectly. - The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	Cited findings from the case study are absent or the cited findings from the case study focus more on reporting what happened and not supporting the analysis.
Did the student provide and submit for feedback asynchronously?	The student submitted the file for feedback and provided appropriate feedback.		
Blacked out performance criteria means that criterion is not applicable to that content area.			

Case Study Evaluation (Paper)

Purpose

This is a scaffolding/formative assignment that supports the Final Case Study Evaluation Paper.

For this academic paper you will assume you are investigating an aviation accident and preparing a written report for an audience of industry professionals in Human Factors, Aviation, and Safety. These professionals are not considered "experts" but are knowledgeable in their field (and only their field). Your report must first clearly articulate the human factors present in the case study and then evaluate how those factors impacted safety.

Objectives

Through this assignment you will **practice** the objectives to 1) Evaluate aviation safety and the impact of human factors on safety, 2) communicate effectively, using written communication skills, 3) use tools to asynchronously collaborate with peers, and 4) Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses….You may complete this assignment in a team therefore you may **practice** the objective to work effectively on multi-disciplinary and diverse teams.

Tasks

1. Review the module reading and the assigned case study.
2. Complete an analysis of the human factors in the assigned case study.
    a. **Introduction to Human Factors**
        i. (100-300 words) What is human factors and what is its importance?
        ii. (200-500 words) Explain one of the following models.

1. HFACS
2. Dirty Dozen
3. SHELL

iii. (100-300 words) Analyze your case study using the model you explained above. You will want to repeat limited parts of your explanation to support your analysis.

b. Ethics and Professionalism

i. (50-200 words) Use at least *one specific key term/concept* to explain the ethical decision making in the case study.

ii. (200-500 words) Use at least *three specific key terms/concepts* to explain any strengths or weaknesses in the professional decision making in the Case Study.

iii. (100-300 words each) Based on the discussion on ethical and professional decision making, explain what each group member would do differently or the same. **Avoid using "I", use the third person if completing this as a group. Cite at least one concept from the reading and a finding from the case study to support your viewpoint.

c. Management of Unsafe Acts

i. (200-500 words) Use at least *three specific key terms/concepts* from this module's reading to describe the unsafe acts present in your case study. **You must identify at least one specific unsafe act (error, violation, TEM error etc).

ii. (100-300 words) Based on your analysis of the unsafe acts, what impact did this human factor have on safety in the case study. Provide reading evidence in the form of an explanation and citation of the human factor's impact on safety to support your viewpoint.

d. Add an introduction with a thesis statement and conclusion.

e. Add an APA Student Title Page and References Page.

f. Submit the paper with evidence of draft revisions.

Criteria for Success

- Remember paying close attention to the assignment instructions and previous assignment feedback is vital to your success. This includes reviewing the full assignment overview and any embedded links.
- This is a scaffolding assignment for the Final Case Study Evaluation Paper and Presentation therefore the Criteria for Success are similar.
- Students should not have the same analysis and evaluation as a peer or another group.
- Follow current APA guidelines.
- Include APA headings for each prompt.
- Include an introduction with a thesis statement and conclusion. The topic sentence of each paragraph must support the thesis statement.
- You must include accurate evidence to support the evaluation. Evidence must be correctly cited and referenced.
- The key terms/concepts you identify in your evaluation must demonstrate a deeper understanding of human factors concepts, therefore the term/concepts you identify in

italics must be specific such as “decision error” and not just “error”. But you can still define/explain the term “error” to help your audience gain a better understanding.

- Specific human factors key terms must be identified in italics, defined/explained to show a deeper understanding of the course concepts, and cited correctly.
- Correctly cited findings from the case study coupled with the key term definitions will establish the validity of your analysis for your audience.
- The paper cannot include more than 2 direct quotes 5-40 words. If you choose to use a direct quote of more than 40 words, you are limited to one direct quote. Using too much quoted material limits the originality of the analysis. You should rely on paraphrasing which demonstrates a deeper understanding of the concepts.

	Yes	Developing	No
Is the APA Title Page Formatted correctly?	No errors in the following: - APA Formatting - Formatting matches the body of the paper - Title Page includes the required information.	Minor (1-2) mistakes in the following: - APA Formatting - Formatting matches the body of the paper - Title Page includes the required information	
Are the APA In-text Citations and End of Text References formatted correctly?	Minor (1-2) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	Multiple (3-4) unique mistakes in page numbers, italics, sentence case, hanging indent, capitalization, spelling, abbreviations, date format, spacing, etc..	
Does the paper have an Introduction and Conclusion?	The paper includes an introduction that previews what the paper will cover with a thesis statement and a conclusion which summarizes the major points.	Introduction OR Conclusion does not adequately preview/summarize the paper.	
Is the paper organization logical and does it add to the understanding of the topic and assignment purpose?	Paper organization is logical and uses headings that correspond to the purpose of the assignment and supports the thesis statement.	Paper organization is logical but DOES NOT use headings that correspond to the purpose of the assignment.	
Are the Mechanics formatted correctly?	All of the following: - All acronyms are formatted according to APA requirements ex. Federal Aviation	One of the following: - Acronyms were not formatted according to APA requirements (ex. Federal Aviation	

	Administration (FAA). - Paragraphs contain topic sentences that support the thesis statement. - Minor (1-2) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	Administration (FAA)). - Some (1-2) paragraphs are missing topic sentences that support the thesis statement. - Multiple (3-4) mistakes in grammar, sentence structure, and spelling, including abbreviations and capitalization.	
Is key term evidence from the reading included?	The required number of key terms/concepts were identified, defined/explained, and cited.	One of the following: - 75% of the required key terms/concepts were identified, defined/explained, and cited. - The required number of key terms/concepts were identified, defined/explained, and cited, but the explanations did not show a deeper understanding of the course materials.	
Is Case Study Evidence included to support the analysis?	Cited findings from the case study are used to support the identification of the human factor key terms/concepts.	One of the following: - Cited findings from the case study are used incorrectly to support the identification of the human factor key terms/concepts.	Cited findings from the case study are absent or the cited findings from the case study focus more on reporting what happened and not supporting the analysis.

		- Findings were interpreted incorrectly. - The cited findings show a narrow view/understanding of the case study facts (other findings contradict the analysis).	
Was the impact human factors has on aviation safety discussed and supported by evidence?	Cited facts were used to support the evaluation of how human factors generally impact safety.		Personal opinion and/or uncited facts were used to support the evaluation of how human factors generally impact safety.
Was the analysis and evaluation an original application of course concepts?	Evaluation used an appropriate number of direct quotes and focused on evaluating the Human Factors and not simply reporting the findings.		Too many direct quotes were used and/or the focus was on repeating the findings and not on conducting an analysis and evaluation.
Blacked out performance criteria means that criterion is not applicable to that content area.			

Objectives:	Exceeds Expectations	Meets Expectations	Developing	Basic	Unsatisfactory
Evaluate aviation safety and the impact of human factors on safety. This is a holistic evaluation of the content areas, Key Terms Evidence, Case Study	Students will earn Exceeds Expectations if the evaluation shows the connections between the factors (the factors aren't analyzed as discrete facts).	Students will earn Meets Expectations if the evaluation of the human factors impact on safety in the case study must be supported by strong evidence from the	Students will earn Developing if their evaluation of the human factors impact on safety in the case study was supported by evidence from the reading and	Students will earn Basic if their analysis shows a basic application of the material to the Case Study, such as identifying the correct number of terms but failing to define/explain them and/or	Students will earn Unsatisfactory if they fail to identify, define/explain, and/or cite the required number of key terms or if their focus is primarily on WHAT happened.

Evidence, and Impact on Safety.		reading and case study that shows a deep understanding of the concepts.	case study but did not show a deeper understanding of the concepts.	how they impacted safety.	
communicate effectively, using written communication skills; This is a holistic evaluation of citations and references, introduction/ conclusion, organization, mechanics, the evaluation of human factors.	Students will earn Exceeds Expectations if the evaluation demonstrates no errors in the conventions of academic writing and clearly articulates a deep understanding of human factors to the intended audience.	Students will earn Meets Expectations if the evaluation demonstrates minor (1-2) errors in the conventions of academic writing and clearly articulates a deep understanding of human factors for the intended.	Students will earn Developing if the evaluation demonstrates minor (1-2) errors in the conventions of academic writing, but at times the student's viewpoint was not clear or the student's viewpoint did not show awareness of the audience (the paper appears to be written for the instructor as the audience).	Students will earn Basic if the evaluation demonstrates multiple (3-4) errors in the conventions of academic writing and clearly articulates a deep understanding of human factors for the intended audience.	Students will earn Unsatisfactory if the evaluation demonstrates multiple (3-4) errors in the conventions of academic writing, and at times the student's viewpoint was not clear or the student's viewpoint did not show awareness of the audience (the paper appears to be written for the instructor as the audience).
use tools to asynchronously collaborate with peers	Students will earn Exceeds Expectations if they submit evidence they used acceptable technological asynchronous tools that provided	The student will earn Meets Expectations if they submit evidence, they used acceptable technological asynchronous tools that	The student will earn Developing if they submit evidence, they used technological tools to collaborate asynchronously that did not	The student will earn Basic if they submit evidence, they did not use technology, but they did collaborate asynchronous	The student will earn Unsatisfactory if they did not use anything to collaborate asynchronously.

	immediate feedback and they utilized that feedback in their submission. This does not include feedback from group members if completing the assignment as team.	provided immediate feedback and they utilized that feedback in their submission (such as Office365 and Google Share Links).	allow for the immediate viewing of updates (such as emailing files).	ly (such as printing copies for review).	
Proactively develop oneself and one's career through continual personal and professional learning, [and] awareness of one's strengths and weaknesses …	The student will earn Exceeds Expectations if they demonstrate considerable attention to detail with no mistakes in grading rubric content areas, makes improvements from instructor feedback and submits evidence of draft revisions based on feedback from someone outside the course with topic or writing expertise.	The student will earn Meets Expectations if they demonstrate considerable attention to detail with mistakes in one or two grading rubric content areas, makes improvements from instructor feedback, and submits evidence of draft revisions based on peer review or self-reflection.	The student will earn Developing if they make mistakes in multiple (3-4) rubric content areas but make improvements based on instructor feedback and submits evidence of draft revisions based on peer review or self-reflection	The student will earn Basic if they make improvements based on instructor feedback OR submits evidence of draft revisions based on peer review or self-reflection	The student will earn Unsatisfactory if they do not make necessary corrections from instructor feedback and do not submit evidence of draft revisions.

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Appendix A: Content Analysis Research Timeline

- November 2022 – First review of select chapters.
    - Martinussen & Hunter (2018)
        - Chapters 3 and 10
    - Moriarty (2015)
        - Chapters 1, 3, 4, and 6
    - Orlady & Orlady (1999)
        - Chapters 3, 4, 5, 6, 7, and 8
- Updated Coding Framework
- January-April 2023 – Recruit raters
- May 2023 – Second Review (included all chapters)
    - Calculated percentage of agreement
    - Updated Coding Framework
    - Provided updated framework to rater
- June 2023 – Third and Final Coding
    - Calculated percentage of agreement
- July 2023 – Received Rater #1's results and calculated percentage of agreement.

Appendix B: Coding Framework Development

Course Catalog Description

Kansas State University AVT 340: Aviation Human Factors Course Catalog Description

"Explores the physical environment and physiology limitations imposed on the aviation professional. Health, fatigue, human behavior and errors, communication, team building, leadership, situation awareness, crew resource management, judgment, and aeronautical decision making are studied to achieve safe and efficient operation."

Health and fatigue were combined to form the subcategory of Aviation Physiology and Aeronautical Decision Making was broadened to "Decision Making". "Human Behavior", "Error", "Communication", "Team Building", "Leadership", "Situation Awareness", and "Crew Resource Management" were pulled directly from the description.

Objectives

The Objectives dimension was synthesized from three different areas of contemporary society: the International Standards for Technology Education (ISTE), National Association of Colleges and Employers (NACE) and the Aviation Accreditation Board International (AABI). Table B-1 shows how these objectives were compared and synthesized.

The ISTE standards for digital citizen, empowered learner, and knowledge constructor were not included in the synthesis (therefore excluded from the table below). The objectives empowered learner and knowledge constructor are supported by the constructivist approach but would not be directly supported in the textbook material. The AABI outcome "d. make professional and ethical decisions;" aligned partially with the NACE Career Readiness Objective "Professionalism", therefore a separate subcategory "Ethics" was also created. NACE Objectives of Leadership and Equity and Inclusion did not have corollaries in ISTE or AABI. The term

Leadership was maintained for the title of that subcategory; however, the term “Socio-Cultural Diversity” was used in lieu of Equity and inclusion since that is the term used in the SKYbrary Article “Managing Socio-Cultural Diversity” I currently use to meet this need in the course.

Table B-1

Synthesized industry objectives, outcomes, and standards

NACE	ISTE	AABI	Code
1. Career and Self-Development - Proactively develop oneself and one's career through continual personal and professional learning, awareness of one's strengths and weaknesses, navigation of career opportunities, and networking to build relationships within and without one's organization.		g. engage in and recognize the need for life-long learning;	Personal and Professional Development
3. Critical Thinking - Identify and respond to needs based upon an understanding of situational context and logical analysis of relevant information.	5. Computational Thinker - Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.	h. assess contemporary issues;	Critical/Creative Thinking
2. Communication - Clearly and effectively exchange information, ideas, facts, and perspectives with persons inside and outside of an organization.	6. Creative Communicator - Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.	e. communicate effectively, using written communication skills;	Written Communication
		f. communicate effectively, using oral communication skills;	Oral Communication
4. Equity and Inclusion - Demonstrate the awareness, attitude, knowledge, and skills required to equitably engage and include people			Socio-cultural Diversity

from different local and global cultures. Engage in anti-racist practices that actively challenge the systems, structures, and policies of racism.			
5. Leadership - Recognize and capitalize on personal and team strengths to achieve organizational goals.			Leadership
6. Professionalism - Knowing work environments differ greatly, understand and demonstrate effective work habits, and act in the interest of the larger community and workplace.		d. make professional and ethical decisions;	Professionalism AND Ethics
7. Teamwork - Build and maintain collaborative relationships to work effectively toward common goals, while appreciating diverse viewpoints and shared responsibilities	7. Global Collaborator - Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.	work effectively on multi-disciplinary and diverse teams;	Teamwork
8. Technology - Understand and leverage technologies ethically to enhance efficiencies, complete tasks, and accomplish goals.	4. Innovative Designer - Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.	i. use the techniques, skills, and modern technology necessary for professional practice;	Technology

CRM Curriculum Topics

The FAA Advisory Circular provides a detailed description of the curriculum topics that should be included in a CRM training program. The list (excluding the explanations) has been included below. Those topics included first, second, and third level topics. For the most part, the lowest level was kept. Exception to this was briefings which was subdivided into safety and security. Also, Workload Management and Situation Awareness and the subsequent lower levels were included in error. Only the lower levels of Planning/Preparation/Vigilance and Workload Distribution/Distraction Avoidance should have been included. Given the broad description of Individual Factors/Stress Reduction to include anything that impact human performance, only stress and fatigue were included in the coding framework for this subcategory.

a. Communications Processes and Decision Behavior
    1. Briefings
    2. Inquiry/Advocacy/Assertion
    3. Crew Self-Critique (Decisions and Actions)
    4. Conflict Resolution
    5. Communications and Decision making
b. Team Building and Maintenance
    1. Leadership/Followership/Concern for Task
    2. Interpersonal Relationships/Group Climate
    3. Workload Management and Situation Awareness
        a) Preparation/Planning/Vigilance
        b) Workload Distribution/Distraction Avoidance
    4. Individual Factors/Stress Reduction

Other Topics

The Other Topics dimensions was included as new topics presented themselves. These topics were due in a large part to the topics I already teach in the course that was not covered by subcategories in other dimensions.

- NOTECHS
- Introduction to Human Factors
- Models
- Threat and Error Management
- Safety Culture
- Culture
- Aircraft Design/Systems

Appendix C: Coding Framework Explanations, Key Terms, and Decision Rules

Table C-1 and Table C-2 show the original coding framework with decisions rules that was provided to the rater and Table C-3 and Table C-4 show the updated version after receiving the rater's results. The grey text on Table C-4 shows the changes made.

Table C-1
Original Coding Framework Dimensions and Subcategories

Description	Objectives	CRM Curriculum Topics	Other Topics
Aviation Physiology	Personal and Professional Development	Briefings	NOTECHS
Human Behavior	Critical/Creative Thinking	Inquiry/Advocacy/Assertion	Introduction to Human Factors
Error	Written Communication	Crew Self-Critique (Decisions and Actions)	Models
Communication	Oral Communication	Conflict Resolution	Threat and Error Management
Team Building	Socio-cultural Diversity	Communications and Decision Making	Safety Culture
Leadership	Leadership	Leadership/Followership/Concern for Task	Culture
Situation Awareness	Professionalism	Interpersonal Relationships/Group Climate	Aircraft Design/Systems
Crew Resource Management	Teamwork	Workload Management and Situation Awareness	

Decision Making	Technology	Preparation/Planning/Vigilance
	Ethics	Workload Distribution/Distraction Avoidance
		Individual Factors/Stress Reduction

Table C-2

Final Coding Framework Dimensions, Subcategories, and Decision Rules

Course Description Codes		
Aviation Physiology	Aviation Physiology is a very broad topic, it includes any topic that relates to the health of the person and their health's impact on performance. However, performance is not included. For CRM: Individual Factors/Stress Reduction stress and fatigue are the specific aviation physiological factors listed, but other topics such as diet, hypoxia, illusions, alcohol, etc. may be included in aviation physiology. Therefore, coding something as Aviation Physiology, does not automatically count as CRM: IF/SR, but the reciprocal is true. Even though Aviation physiology impacts human behavior, these topics do not immediately require the inclusion of human behavior unless it directly addresses concept(s) included in human behavior.	
	Key Terms	See Also
	Fatigue	CRM: Individual Factors/Stress Reduction
	Stress (types of and duration)	CRM: Individual Factors/Stress Reduction
	Illusions	
	Spatial Disorientation	
	Mental Health	
	Sleep	
	Chronotypes	
	Insomnia	
	Diet and Nutrition	

	Incapacitance	
	Carbon Dioxide	
	Decompression Sickness	
	Eyes/Vision	
	Hyperventilation	
	Hypoxia (types of or causes of)	
	Time of Safe/Useful Consciousness	
	Circadian Rhythms (Biological Clock)	
	Alcohol (effect, abuse and/or dependence)	
Human Behavior	Human Behavior should include topics that explain why people do what they do. This can include a broad range of topics if those topics are explained in a way to explain Human Behavior. This topic is very closely related to teamwork, followership, and leadership. Even though aviation physiology impacts human behavior, those topics do not immediately require the inclusion of human behavior unless it directly addresses concept(s) included in human behavior.	
	Key Terms	See Also
	Culture (how it impacts Human Behavior)	DES: Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Authority Gradient	DES/OBJ: Leadership, DES/OBJ: Teamwork and Teambuilding OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Ability	
	Emotional Intelligence	
	Intelligence	
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding , CRM: Inquiry/Advocacy/Assertion, , Conflict Resolution, Interpersonal Relationships/Group Climate

	Behavior	
	Personality (Personality models/types)	DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate, Individual Factors/Stress Reduction
Error	There are several different ways to categorize human error, but it includes why people commit errors and violations (sometimes referred to as unsafe acts or other terms). This topic can be related to several other topics such as Human Behavior and Culture, but these other topics are only relevant if they discuss how they impact human Error. Threat and Error Management should be included in Error but is also a standalone topic in "Other Topics".	
	Key Terms	See Also
	(Organizational) Resilience Engineering	Other Topics: Culture
	Old and New Views of Safety (aka Safety I and II)	Other Topics: Culture
	Safety Culture Subcultures	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Hudson Safety Culture Levels	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Safety Culture	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Threat and Error Management (TEM)	Other Topics: Threat and Error Management
	Unsafe Acts	
	Violation (and Types of)	
	Memory (and Errors)	
	Error (and types of)	
	Communication is a vital part of the aviation industry, and it includes written and oral communication. Sometimes written and oral communication are not overtly explained and therefore	

<table>
<tr><td>Communication (and Objective: Written and Oral Communication)</td><td>you must use judgement based on the context of the material. Communication should be identified as a topic if the material is discussing how to improve, understand, or utilize communication. Written communication may include policies, procedures, rules regulations, charts, and maps. Oral communication can include radio calls, briefings, and others.

<table>
<tr><th>Key Terms</th><th>Written or Oral Communication</th><th>See Also</th></tr>
<tr><td>Briefings</td><td>OBJ: Oral Communication</td><td>CRM: Briefings</td></tr>
<tr><td>Coordination</td><td>OBJ: Oral Communication</td><td>CRM: Planning/Preparation/Vigilance</td></tr>
<tr><td>Checklists</td><td>OBJ: Written Communication</td><td>CRM: Planning/Preparation/Vigilance</td></tr>
<tr><td>Communication Models</td><td>OBJ: Oral and Written Communication</td><td></td></tr>
<tr><td>Non-verbal communication</td><td>OBJ: Oral and Written Communication</td><td></td></tr>
<tr><td>Cabin-Cockpit Communication</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Intra-Cabin Communication</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Sterile Cockpit Rule</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Hearback</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Readback</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>The ICAO (Phonetic) Alphabet</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Verbal communication</td><td>OBJ: Oral Communication</td><td></td></tr>
<tr><td>Graphical (Written) Communication</td><td>OBJ: Written Communication</td><td></td></tr>
<tr><td>Written communication</td><td>OBJ: Written Communication</td><td></td></tr>
<tr><td>Communication</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Leadership (and Objective: Leadership)</td><td>Leadership is connected to human behavior, followership, teamwork, and Interpersonal Relationships/Group Climate but in this case, it should be analyzed separately from those topics. Leadership should only be marked if the discussion includes understanding or improving leadership,</td></tr>
</table>

	the term leadership does not have to necessarily be used. If CRM Leadership/Followership/Concern for Task is indicated then leadership is included, the reciprocal is not necessarily true.	
	Key Terms	See Also
	Authority Gradient	DES/OBJ: Teamwork and Teambuilding OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Authority with Participation	
	Leadership (Styles/Approaches/Types of)	DES/OBJ: Teamwork and Teambuilding, CRM: Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate
Decision Making (including Objective: Critical Thinking)	Decision making terms may appear to be related to Situational Awareness, Human Behavior and/or Error, but decision making should be analyzed separately. These terms are not duplicated on another list. Decision making may include how humans gather and act on information from their environment and factors that may impact decision making.	
	Key Terms	See Also
	Aeronautical Decision Making (ADM)	
	Decision Making Models (other than ADM or DECIDE)	
	Decision-Making	
	Hazardous Attitudes (in relation to decision making and/or critical thinking)	
	Operational Pitfalls (in relation to decision making and/or critical thinking)	
	The DECIDE Model	
	Heuristics	
	Biases	
	Perception	

	Information Processing Critical Thinking	
Situation(al) Awareness	A simple definition of Situation(al) Awareness (SA) is sufficient to be marked as situational awareness. SA is connected to Preparation/Planning/Vigilance and Workload and SA if the discussion includes how SA impacts preparation/planning/vigilance and Workload and SA. CRM Workload and Situational Awareness should not be marked if it only discusses SA.	
	Key Terms Definition of Situation(al) Awareness Purpose/Importance of Situation(al) Awareness	See Also CRM: Preparation/Planning/Vigilance and Workload and SA
Crew Resource Management	For Crew Resource Management (CRM) to be indicated, the discussion must go beyond simply mentioning the term. CRM must be explained in some way for the reader to be introduced to the concept.	
	Key Terms History of CRM CRM Effectiveness Definition of CRM Purpose/Importance of CRM	
Teambuilding (including Objective: Teamwork)	Teamwork and Teambuilding are closely related, but teambuilding is what happens before a team can work together effectively. Teambuilding may include establishing a cockpit or team atmosphere conducive to teamwork. Leadership or followership on their own is not sufficient to be considered teambuilding or teamwork, but the two concepts together are enough to code as teamwork. Human Behavior and Culture can impact Teamwork and Teambuilding. Teamwork is also related to the CRM Topics Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate.	
	Key Terms Authority Gradient (how it impacts teamwork)	Teamwork/Teambuilding OBJ: Teamwork See Also DES/OBJ: Leadership, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern

		for Task, Interpersonal Relationships/Group Climate
National Culture (and Dimensions) (how it impacts teamwork)	OBJ: Teamwork	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
Conflict Resolution/Solving	OBJ: Teamwork	DES: Human Behavior, CRM: Inquiry/Advocacy/Assertion, Conflict Resolution, Interpersonal Relationships/Group Climate
Team Building	DES: Teambuilding and OBJ: Teamwork	
Team Maintenance	DES: Teambuilding and OBJ: Teamwork	
Leadership (and followers/subordinates)	DES: Teambuilding, OBJ: Teamwork	DES/OBJ: Leadership, CRM: Leadership/Followership/Concern for Task
Team Atmosphere	DES: Teambuilding	

Objectives Codes	
Personal and Professional Development	Personal and Professional Development includes the knowledge and skills to understand the importance of and participate in self-reflection, self-improvement, and life-long learning.
Socio-Cultural Diversity	Socio-Cultural Diversity should only be identified if the discussion focuses on understanding and working with different Cultures.

Key Terms	See Also
Authority Gradient (how it is impacted by Culture)	DES/OBJ: Leadership, DES/OBJ: Teamwork and Teambuilding, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
Culture (types of)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture

	National Culture (and Dimensions)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
Professionalism	This may include an explanation of professional conduct, how to recognize professionalism, and how to build professionalism. This discussion may be specific to aviation or general to all professionals.	
Technology	Technology includes any and all of the technology aviation professionals are expected to be able to utilize in professional practice.	
	Key Terms	See Also
	Electronic Flight Bag General Characteristics of Humans as a System Component Principles of Display Design Automation Bias Automation Surprise Autopilot/Autothrottle Flight Control Laws Flight Director Flight Guidance System (FGS) Flight Mode Annunciators (FMA) Levels of Automation Mode Control Panel Skill Fade Control and Display Unit (CDU) Types of Automation Flight Management Computer (FMC) Mode Confusion Automation Complacency	

	Flight Management System (FMS)	
Ethics	This may include an explanation of ethics, morality, or the differences/similarities between the two and how to behave ethically. This discussion may be specific to aviation or general to all ethics.	
	Key Terms	See Also
	Ethics	
	Morals	
	Crew Resource Management Curriculum Topics Codes	
Briefings	Briefings are a method of oral communication to coordinate with others. This topic is related to Communication.	
	Key Terms	See Also
	Briefings	DES: Communication
Inquiry /Advocacy /Assertion	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Inquiry/Advocacy/Assertion is "[t]raining in the potential benefits of crewmembers advocating the course of action that they feel is best, even though it may involve conflict with others."	
	Key Terms	See Also
	Assertiveness (with respect)	CRM: Leadership/Followership/Concern for Task
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding , CRM: Conflict Resolution, Interpersonal Relationships/Group Climate
Crew Self-Critique (Decisions and Actions)	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Crew Self-Critique (Decisions and Actions) is "[i]llustrating the value of review, feedback, and critique focusing on the process and the people involved. One of the best techniques for reinforcing effective human factors practices is careful debriefing of activities, highlighting the processes that were followed. Additionally, it is essential that each crewmember be able to recognize good and bad communications, and effective and ineffective team behavior."	
Conflict Resolution	Conflict Resolution is related to Interpersonal Relationships/Group Climate, Human Behavior, teambuilding and teamwork. It includes methods of dealing with disagreements with others. According to the FAA Advisory Circular 120-51E Crew Resource Management Training Conflict Resolution is "[d]emonstrating effective techniques of resolving disagreements among crewmembers	

	in interpreting information or in proposing courses of action. Demonstrating effective techniques for maintaining open communication while dealing with conflict."	
	Key Terms	See Also
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding, CRM: Inquiry/Advocacy/Assertion and Interpersonal Relationships/Group Climate
Communication and Decision Making	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Communication and Decision Making is "[d]emonstrating effective techniques of seeking and evaluating information. Showing the influence of biases and other cognitive factors on decision quality. There are benefits in providing crews with operational models of this group decision process. Crews may refer to these models to make good choices in situations when information is incomplete or contradictory." This FAA definition focuses more on decision making than communication, but to fulfill this topic, the text needs to discuss communication as part of the decision making process, for example providing information, discussing options and/or communicating the final decision.	
	See Communication	
	See Decision Making	
Preparation /Planning /Vigilance	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Preparation/Planning/Vigilance "[i]ssues include methods to improve monitoring and accomplishing required tasks, asking for and responding to new information, and preparing in advance for required activities."	
	Key Terms	See Also
	Situation(al) Awareness	DES: Situation(al) Awareness, CRM: Preparation/Planning/Vigilance and Workload and Situation Awareness
	Coordination	
	Checklists	
	Briefings	
	Information Management	
Interpersonal Relationships /Group Climate	Essentially Interpersonal Relationships/Group Climate is an aggregate of Human Behavior and teamwork/teambuilding. But the discussion must focus on the two aspects together, not separately.	

	FAA Advisory Circular 120-51E explains that Interpersonal Relationships/Group Climate is "[d]emonstrating the usefulness of showing sensitivity to other crewmembers' personalities and styles. Emphasizing the value of maintaining a friendly, relaxed, and supportive yet task-oriented tone in the cockpit and aircraft cabin. The importance of recognizing symptoms of fatigue and stress, and taking appropriate action."	
	Key Terms	See Also
	Emotional Intelligence	DES: Human Behavior
	Personality (Personality Types and Models)	DES: Human Behavior, DES/OBJ: Teambuilding and Teamwork, CRM: Individual Factors/Stress Reduction
	Culture (how it impacts Human Behavior)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding , CRM: Inquiry/Advocacy/Assertion, , Conflict Resolution
	Authority Gradient (how it impacts teamwork)	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Team Atmosphere	DES: Teambuilding
	Followership	DES/OBJ: Teambuilding and Teamwork
	Leadership	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, CRM: Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate
	Team Building	DES: Teambuilding
	Team Maintenance	DES/OBJ: Teambuilding and Teamwork
Leadership /Followership /Concern for Task	Leadership/Followership/Concern for Task is very similar to Leadership, Teambuilding and Teamwork, and Interpersonal Relationships but the focus needs to be on how the leader prioritizes tasks and interacts with subordinates. Only discussing one aspect of this triad is not sufficient to be coded as L/F/C. If a chapter satisfies L/F/C then it subsequently satisfies the Leadership. The FAA Advisory Circular 120-51E Crew Resource Management Training explains	

	Leadership/Followership/Concern for Task is "[s]howing the benefits of the practice of effective Leadership through coordinating activities and maintaining proper balance between respecting authority and practicing assertiveness. Staying centered on the goals of safe and efficient operations."	
	Key Terms	See Also
	Authority Gradient	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Leadership Styles/Approaches/Types of	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate
	Followership	
	Assertiveness (with Respect)	CRM: Inquiry/Advocacy/Assertion,
	Authority with Participation	
Workload and Situation Awareness	Workload/Task load and Situational Awareness must be discussed together to be workload and situational awareness. According to the FAA Advisory Circular 120-51E Workload and Situational Awareness includes "[s]tressing the importance of maintaining awareness of the operational environment and anticipating contingencies. Instruction may address practices … result in higher levels of situation awareness." Discussing one topic is not sufficient, exception being if the precepts of situational awareness are included, but the term itself is not.	
	Key Term	See also
	Situation(al) Awareness	DES: Situation(al) Awareness
	Workload	CRM: Workload and Distraction Avoidance
	Task load	CRM: Workload and Distraction Avoidance
Workload and Distractions Avoidance	Workload and distraction avoidance also requires both concepts to be identified. FAA Advisory Circular 120-51E says that Workload and Distraction Avoidance involves the "proper allocation of tasks to individuals, avoidance of work overloads in self and in others, prioritization of tasks during periods of high workload, and preventing nonessential factors from distracting attention from adherence to SOPs, particularly those relating to critical tasks."	
	Key Terms	See Also
	Workload	CRM: Workload and Situation Awareness

	Task load	CRM: Workload and Situation Awareness
	Distractions	
Individual Factors/Stress Reduction	Individual Factors/Stress Reduction should include any factors that impact crew performance, with an emphasis on stress and fatigue. These factors may impact decision making, communication, and interpersonal relationships. These topics may overlap several other topics, but the emphasis is on their impact on performance. Simply defining or explaining the topic is not sufficient.	
	Key Terms	See Also
	Fatigue (impact on performance)	DES: Aviation Physiology
	Stress (impact on performance)	DES: Aviation Physiology
	Personality (impact on performance)	DES: Human Behavior, DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate, Individual Factors/Stress Reduction
	Coping with Stress	
	Other Topics Codes	
NOTECHS	NOTECHS is a model developed in Europe to analyze pilot non-technical skills.	
Introduction to Human Factors		
Accident Causation Models	Accident causation analysis models help understand why accidents happen, specifically the human factors involved.	
	Key Terms	See Also
	Human Factors Analysis Classification Systems (HFACS)	
	SHELL Model	
	Swiss Cheese Model	
	5-Factor Model	
Threat and Error Management (TEM)	Threat and Error Management (TEM) is a model of identifying and managing threats, Errors, and undesired aircraft states.	
	Key Terms	See Also

	Threat and Error Management (TEM) (Purpose, Definition, Importance of)	DES: Error
Safety Culture	According to the FAA, Safety Culture can be defined as "Safety culture can be very simply defined as an organizational commitment to safety at all levels of operation." For the purposes of coding safety culture, the term and explanation of safety culture needs to be present. The explanation does not need to be the same definition provided above.	
	Key Terms	See Also
	Safety Culture Subcultures	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
	Hudson Safety Culture Levels	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
	Safety Culture	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
Culture	Dictionary.com defines culture as the behaviors and beliefs characteristic of a particular group of people, as a social, ethnic, professional, or age group (usually used in combination).	
	Key Terms	See Also
	Culture (types of)	DES: Human Behavior and Error, OBJ: Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	Safety Culture Subcultures	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	Hudson Safety Culture Levels	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture

	Safety Culture	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	National Culture (and Dimensions)	DES: Human Behavior and Error, OBJ: Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
Aircraft Design /Systems	This topic covers the human-machine interface and why/how aircraft are designed to mitigate human factors.	

Table C-3

Updated Coding Framework Dimensions and Subcategories

Description	Objectives	CRM Curriculum Topics	Other Topics
Aviation Physiology	Personal and Professional Development	Briefings	NOTECHS
Human Behavior	Critical/Creative Thinking	Inquiry/Advocacy/Assertion	Introduction to Human Factors
Error	Written Communication	Crew Self-Critique (Decisions and Actions)	Models
Communication	Oral Communication	Conflict Resolution	Threat and Error Management
Team Building	Socio-cultural Diversity	Communications and Decision Making	Safety Culture
Leadership	Leadership	Leadership/Followership/Concern for Task	Culture
Situation Awareness	Professionalism	Interpersonal Relationships/Group Climate	Aircraft Design/Systems
Crew Resource Management	Teamwork	Workload Management and Situation Awareness	
Decision Making	Technology	Preparation/Planning/Vigilance	
	Ethics	Workload Distribution/Distraction Avoidance	
		Individual Factors/Stress Reduction	

Table C-4

Final Coding Framework Dimensions, Subcategories, and Decision Rules

Course Description Subcategories

Aviation Physiology	Aviation Physiology is a very broad topic, it includes any topic that relates to the health of the person and their health's impact on performance. However, performance is not included. For CRM: Individual Factors/Stress Reduction stress and fatigue are the specific aviation physiological factors listed, but other topics such as diet, hypoxia, illusions, alcohol, etc. may be included in aviation physiology. Therefore, coding something as Aviation Physiology, does not automatically count as CRM: IF/SR, but the reciprocal is true. Even though Aviation physiology impacts human behavior, these topics do not immediately require the inclusion of human behavior unless it directly addresses concept(s) included in human behavior.
	Key Terms — See Also
	Fatigue — CRM: Individual Factors/Stress Reduction
	Stress (types of and duration) — CRM: Individual Factors/Stress Reduction
	Illusions
	Spatial Disorientation
	Mental Health
	Sleep
	Chronotypes
	Insomnia
	Diet and Nutrition
	Incapacitance
	Carbon Dioxide
	Decompression Sickness
	Eyes/Vision
	Hyperventilation
	Hypoxia (types of or causes of)
	Time of Safe/Useful Consciousness
	Circadian Rhythms (Biological Clock)
	Alcohol (effect, abuse and/or dependence)
Human Behavior	Human Behavior should include topics that explain why people do what they do. This can include a broad range of topics if those topics are explained in a way to explain Human Behavior. This topic is very closely related to

	teamwork, followership, and leadership. Even though aviation physiology impacts human behavior, those topics do not immediately require the inclusion of human behavior unless it directly addresses concept(s) included in human behavior.	
	Key Terms	See Also
	Culture (how it impacts Human Behavior)	DES: Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Authority Gradient	DES/OBJ: Leadership, DES/OBJ: Teamwork and Teambuilding OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Ability	
	Emotional Intelligence	
	Intelligence	
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding, CRM: Inquiry/Advocacy/Assertion, , Conflict Resolution, Interpersonal Relationships/Group Climate
	Behavior	
	Personality (Personality models/types)	DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate, Individual Factors/Stress Reduction
Error	There are several different ways to categorize human error, but it includes why people commit errors and violations (sometimes referred to as unsafe acts or other terms). This topic can be related to several other topics such as Human Behavior and Culture, but these other topics are only relevant if they discuss how they impact human Error. Threat and Error Management should be included in Error but is also a standalone topic in "Other Topics".	
	Key Terms	See Also
	(Organizational) Resilience Engineering	Other Topics: Culture
	Old and New Views of Safety (aka Safety I and II)	Other Topics: Culture
	Safety Culture Subcultures	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture

	Hudson Safety Culture Levels	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Safety Culture	DES: Human Behavior, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Threat and Error Management (TEM)	Other Topics: Threat and Error Management
	Unsafe Acts	
	Violation (and Types of)	
	Memory (and Errors)	
	Error (and types of)	

Communication (and Objective: Written and Oral Communication)

Communication is a vital part of the aviation industry, and it includes written and oral communication. Sometimes written and oral communication are not overtly explained and therefore you must use judgement based on the context of the material. Communication should be identified as a topic if the material is discussing how to improve, understand, or utilize communication. Written communication may include policies, procedures, rules regulations, charts, and maps. Oral communication can include radio calls, briefings, and others.

Key Terms	Written or Oral Communication	See Also
Briefings	OBJ: Oral Communication	CRM: Briefings
Coordination	OBJ: Oral Communication	CRM: Planning/Preparation/Vigilance
Checklists	OBJ: Written Communication	CRM: Planning/Preparation/Vigilance
Communication Models	OBJ: Oral and Written Communication	
Non-verbal communication	OBJ: Oral and Written Communication	
Cabin-Cockpit Communication	OBJ: Oral Communication	
Intra-Cabin Communication	OBJ: Oral Communication	
Sterile Cockpit Rule	OBJ: Oral Communication	
Hearback	OBJ: Oral Communication	

	Readback	OBJ: Oral Communication
	The ICAO (Phonetic) Alphabet	OBJ: Oral Communication
	Verbal communication	OBJ: Oral Communication
	Graphical (Written) Communication	OBJ: Written Communication
	Written communication	OBJ: Written Communication
	Communication	
Leadership (and Objective: Leadership)	Leadership is connected to human behavior, followership, teamwork, and Interpersonal Relationships/Group Climate but in this case, it should be analyzed separately from those topics. Leadership should only be marked if the discussion includes understanding or improving leadership, the term leadership does not have to necessarily be used. If CRM Leadership/Followership/Concern for Task is indicated then leadership is included, the reciprocal is not necessarily true.	
	Key Terms	See Also
	Authority Gradient	DES/OBJ: Teamwork and Teambuilding OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Authority with Participation	
	Leadership (Styles/Approaches/Types of)	DES/OBJ: Teamwork and Teambuilding, CRM: Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate
Decision Making (including Objective: Critical Thinking)	Decision making terms may appear to be related to Situational Awareness, Human Behavior and/or Error, but decision making should be analyzed separately. These terms are not duplicated on another list. Decision making may include how humans gather and act on information from their environment and factors that may impact decision making.	
	Key Terms	See Also
	Aeronautical Decision Making (ADM)	
	Decision Making Models (other than ADM or DECIDE)	
	Decision-Making	

	Hazardous Attitudes (in relation to decision making and/or critical thinking) Operational Pitfalls (in relation to decision making and/or critical thinking) The DECIDE Model Heuristics Biases Perception Information Processing Critical Thinking	
Situation(al) Awareness	A simple definition of Situation(al) Awareness (SA) is sufficient to be marked as situational awareness. SA is connected to Preparation/Planning/Vigilance and Workload and SA if the discussion includes how SA impacts preparation/planning/vigilance and Workload and SA. CRM Workload and Situational Awareness should not be marked if it only discusses SA.	
	Key Terms	See Also
	Definition of Situation(al) Awareness Purpose/Importance of Situation(al) Awareness	CRM: Preparation/Planning/Vigilance and Workload and SA
Crew Resource Management	For Crew Resource Management (CRM) to be indicated, the discussion must go beyond simply mentioning the term. CRM must be explained in some way for the reader to be introduced to the concept.	
	Key Terms History of CRM CRM Effectiveness Definition of CRM Purpose/Importance of CRM	

Teambuilding (including Objective: Teamwork)	Teamwork and Teambuilding are closely related, but teambuilding is what allows a team to work together effectively. Teambuilding may include establishing a cockpit or team atmosphere conducive to teamwork. Leadership or followership on their own is not sufficient to be considered teambuilding or teamwork, but the two concepts together are enough to code as teamwork. Human Behavior and Culture can impact Teamwork and Teambuilding. Teamwork is also related to the CRM Topics Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate.		
	Key Terms	Teamwork/Teambuilding Objectives Codes	See Also
	Authority Gradient (how it impacts teamwork)	OBJ: Teamwork	DES/OBJ: Leadership, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	National Culture (and Dimensions) (how it impacts teamwork)	OBJ: Teamwork	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Conflict Resolution/Solving	OBJ: Teamwork	DES: Human Behavior, CRM: Inquiry/Advocacy/Assertion, Conflict Resolution, Interpersonal Relationships/Group Climate
	Team Building	DES: Teambuilding and OBJ: Teamwork	
	Team Maintenance	DES: Teambuilding and OBJ: Teamwork	
	Leadership (and followers/subordinates)	DES: Teambuilding, OBJ: Teamwork	DES/OBJ: Leadership, CRM: Leadership/Followership/Concern for Task
	Team Atmosphere	DES: Teambuilding	

Personal and Professional Development	Personal and Professional Development includes the knowledge and skills to understand the importance of and participate in self-reflection, self-improvement, and life-long learning. To be considered P&PD, the text must be intentional in presenting these topics.	
	Key Terms	See Also
	Professionalism	
	Professional Conduct/Behavior (not human behavior)	
Socio-Cultural Diversity	Socio-Cultural Diversity should only be identified if the discussion focuses on understanding and working with different Cultures.	
	Key Terms	See Also
	Authority Gradient (how it is impacted by Culture)	DES/OBJ: Leadership, DES/OBJ: Teamwork and Teambuilding, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Culture (types of)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	National Culture (and Dimensions)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
Professionalism	This may include an explanation of professional conduct, how to recognize professionalism, and how to build professionalism. This discussion may be specific to aviation or general to all professionals.	
Technology	Technology includes any and all of the technology aviation professionals are expected to be able to utilize in professional practice.	
	Key Terms	See Also
	Electronic Flight Bag	
	General Characteristics of Humans as a System Component	
	Principles of Display Design	
	Automation Bias	
	Automation Surprise	

	Autopilot/Autothrottle Flight Control Laws Flight Director Flight Guidance System (FGS) Flight Mode Annunciators (FMA) Levels of Automation Mode Control Panel Skill Fade Control and Display Unit (CDU) Types of Automation Flight Management Computer (FMC) Mode Confusion Automation Complacency Flight Management System (FMS)	
Ethics	This may include an explanation of ethics, morality, or the differences/similarities between the two and how to behave ethically. This discussion may be specific to aviation or general to all ethics.	
	Key Terms	See Also
	Ethics Morals	
	Crew Resource Management Curriculum Topics Codes	
Briefings	Briefings are a method of oral communication to coordinate with others. This topic is related to Communication.	
	Key Terms	See Also
	Briefings	DES: Communication
Inquiry /Advocacy /Assertion	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Inquiry/Advocacy/Assertion is "[t]raining in the potential benefits of crewmembers advocating the course of action that they feel is best, even though it may involve conflict with others."	
	Key Terms	See Also

	Assertiveness (with respect)	CRM: Leadership/Followership/Concern for Task
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding, CRM: Conflict Resolution, Interpersonal Relationships/Group Climate
Crew Self-Critique (Decisions and Actions)	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Crew Self-Critique (Decisions and Actions) is "[i]llustrating the value of review, feedback, and critique focusing on the process and the people involved. One of the best techniques for reinforcing effective human factors practices is careful debriefing of activities, highlighting the processes that were followed. Additionally, it is essential that each crewmember be able to recognize good and bad communications, and effective and ineffective team behavior."	
Conflict Resolution	Conflict Resolution is related to Interpersonal Relationships/Group Climate, Human Behavior, teambuilding and teamwork. It includes methods of dealing with disagreements with others. According to the FAA Advisory Circular 120-51E Crew Resource Management Training Conflict Resolution is "[d]emonstrating effective techniques of resolving disagreements among crewmembers in interpreting information or in proposing courses of action. Demonstrating effective techniques for maintaining open communication while dealing with conflict."	
	Key Terms	See Also
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding, CRM: Inquiry/Advocacy/Assertion and Interpersonal Relationships/Group Climate
Communication and Decision Making	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Communication and Decision-Making is "[d]emonstrating effective techniques of seeking and evaluating information. Showing the influence of biases and other cognitive factors on decision quality. There are benefits in providing crews with operational models of this group decision process. Crews may refer to these models to make good choices in situations when information is incomplete or contradictory." This FAA definition focuses more on decision making than communication, but to fulfill this topic, the text needs to discuss communication as part of the decision-making process, for example providing information, discussing options and/or communicating the final decision.	
	See Communication	
	See Decision Making	
Preparation /Planning /Vigilance	According to the FAA Advisory Circular 120-51E Crew Resource Management Training Preparation/Planning/Vigilance "[i]ssues include methods to improve monitoring and accomplishing required tasks, asking for and responding to new information, and preparing in advance for required activities."	

	Key Terms	See Also
	Situation(al) Awareness	DES: Situation(al) Awareness, CRM: Preparation/Planning/Vigilance and Workload and Situation Awareness
	Coordination	
	Checklists	
	Briefings	
	Information Management	
Interpersonal Relationships /Group Climate	Essentially Interpersonal Relationships/Group Climate is an aggregate of Human Behavior and teamwork/teambuilding. But the discussion must focus on the two aspects together, not separately. FAA Advisory Circular 120-51E explains that Interpersonal Relationships/Group Climate is "[d]emonstrating the usefulness of showing sensitivity to other crewmembers' personalities and styles. Emphasizing the value of maintaining a friendly, relaxed, and supportive yet task-oriented tone in the cockpit and aircraft cabin. The importance of recognizing symptoms of fatigue and stress and taking appropriate action."	
	Key Terms	See Also
	Emotional Intelligence	DES: Human Behavior
	Personality (Personality Types and Models)	DES: Human Behavior, DES/OBJ: Teambuilding and Teamwork, CRM: Individual Factors/Stress Reduction
	Culture (how it impacts Human Behavior)	DES: Human Behavior and Error, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture and Safety Culture
	Conflict Resolution/Solving	DES: Human Behavior, DES/OBJ: Teamwork and Teambuilding, CRM: Inquiry/Advocacy/Assertion,, Conflict Resolution
	Authority Gradient (how it impacts teamwork)	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Team Atmosphere	DES: Teambuilding
	Followership	DES/OBJ: Teambuilding and Teamwork

	Leadership	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, CRM: Leadership/Followership/Concern for Task and Interpersonal Relationships/Group Climate
	Team Building	DES: Teambuilding
	Team Maintenance	DES/OBJ: Teambuilding and Teamwork
Leadership /Followership /Concern for Task	Leadership/Followership/Concern for Task is very similar to Leadership, Teambuilding and Teamwork, and Interpersonal Relationships but the focus needs to be on how the leader prioritizes tasks and interacts with subordinates. Only discussing one aspect of this triad is not sufficient to be coded as L/F/C. If a chapter satisfies L/F/C, then it subsequently satisfies the Leadership. The FAA Advisory Circular 120-51E Crew Resource Management Training explains Leadership/Followership/Concern for Task is "[s]howing the benefits of the practice of effective Leadership through coordinating activities and maintaining proper balance between respecting authority and practicing assertiveness. Staying centered on the goals of safe and efficient operations."	
	Key Terms	See Also
	Authority Gradient	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, OBJ: Socio-Cultural Diversity, CRM: Leadership/Followership/Concern for Task, Interpersonal Relationships/Group Climate
	Leadership Styles/Approaches/Types of Followership	DES/OBJ: Leadership, DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate
	Assertiveness (with Respect)	CRM: Inquiry/Advocacy/Assertion,
	Authority with Participation	
Workload and Situation Awareness	Workload/Task load and Situational Awareness must be discussed together to be workload and situational awareness. According to the FAA Advisory Circular 120-51E Workload and Situational Awareness includes "[s]tressing the importance of maintaining awareness of the operational environment and anticipating contingencies. Instruction may address practices … result in higher levels of situation awareness." Discussing one topic is not sufficient, exception being if the precepts of situational awareness are included, but the term itself is not.	
	Key Term	See also
	Situation(al) Awareness	DES: Situation(al) Awareness

	Workload	CRM: Workload and Distraction Avoidance
	Task load	CRM: Workload and Distraction Avoidance
Workload and Distractions Avoidance	Workload and distraction avoidance also requires both concepts to be identified. FAA Advisory Circular 120-51E says that Workload and Distraction Avoidance involves the "proper allocation of tasks to individuals, avoidance of work overloads in self and in others, prioritization of tasks during periods of high workload, and preventing nonessential factors from distracting attention from adherence to SOPs, particularly those relating to critical tasks."	
	Key Terms	See Also
	Workload	CRM: Workload and Situation Awareness
	Task load	CRM: Workload and Situation Awareness
	Distractions	
Individual Factors/Stress Reduction	Individual Factors/Stress Reduction should include any factors that impact crew performance, with an emphasis on stress and fatigue. These factors may impact decision making, communication, and interpersonal relationships. These topics may overlap with several other topics, but the emphasis is on their impact on performance. Simply defining or explaining the topic is not sufficient.	
	Key Terms	See Also
	Fatigue (impact on performance)	DES: Aviation Physiology
	Stress (impact on performance)	DES: Aviation Physiology
	Personality (impact on performance)	DES: Human Behavior, DES/OBJ: Teambuilding and Teamwork, CRM: Interpersonal Relationships/Group Climate, Individual Factors/Stress Reduction
	Coping with Stress	
	Other Topics Codes	
NOTECHS	NOTECHS is a model developed in Europe to analyze pilot non-technical skills.	
Introduction to Human Factors		
Accident Causation Models	Accident causation analysis models help understand why accidents happen, specifically the human factors involved.	
	Key Terms	See Also

	Human Factors Analysis Classification Systems (HFACS) SHELL Model Swiss Cheese Model 5-Factor Model	
Threat and Error Management (TEM)	Threat and Error Management (TEM) is a model of identifying and managing threats, Errors, and undesired aircraft states.	
	Key Terms	See Also
	Threat and Error Management (TEM) (Purpose, Definition, Importance of)	DES: Error
Safety Culture	According to the FAA, Safety Culture can be defined as "Safety culture can be very simply defined as an organizational commitment to safety at all levels of operation." For the purposes of coding safety culture, the term and explanation of safety culture needs to be present. The explanation does not need to be the same definition provided above.	
	Key Terms	See Also
	Safety Culture Subcultures	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
	Hudson Safety Culture Levels	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
	Safety Culture	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Culture
Culture	Dictionary.com defines culture as the behaviors and beliefs characteristic of a particular group of people, as a social, ethnic, professional, or age group (usually used in combination).	
	Key Terms	See Also
	Culture (types of)	DES: Human Behavior and Error, OBJ: Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture

	Safety Culture Subcultures	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	Hudson Safety Culture Levels	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	Safety Culture	DES: Human Behavior and Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
	National Culture (and Dimensions)	DES: Human Behavior and Error, OBJ: Socio-Cultural Diversity, CRM: Interpersonal Relationships/Group Climate, Other Topics: Safety Culture
Aircraft Design /Systems	This topic covers the human-machine interface and why/how aircraft are designed to mitigate human factors.	

Appendix D: Books Considered for inclusion in the Research

Table D-1

Books Considered for inclusion in the Research

Text Reference	Reason for exclusion
Beaty, D. (1995). *The naked pilot: The human factor in aircraft accidents*. Airlife.	The title indicated it was only for pilots, and a review of the table of contents showed a possible limited scope of this book.
Caldwell Jr., J.A. & Caldwell J.L. (2003). *Fatigue in aviation: A guide to staying awake at the stick.* Ashgate.	This text only focused on fatigue. This is an important subject, but too limited in scope for this review.
Campbell, R.D. & Bagshaw M. (2002). *Human performance and limitations in aviation*. Blackwell Science.	This text was mainly excluded because of its length. I was concerned the depth of information would not be sufficient for a course text.
Harris, D. & Muir, H.C. (2001). *Contemporary issues in human factors and aviation safety*. Routledge.	This text was excluded because it was an edited book with multiple contributors. Since these articles were reprinted from four years of the Journal of Human Factors and Aerospace Safety, I thought it would be best as a source for my textbook.
Keebler, J.R. Lazzara, E.H., Wilson, K.A., & Blickensderfer, E.L. (2023). *Human factors in aviation and aerospace* (3rd ed.). Elsevier.	Originally, I had excluded the second edition of this book because it had multiple contributors (that had not been reprinted from other sources). The third was published after I chose my books for review, but still decided to exclude it for the same reason the second edition was excluded.
Landry, S.J. (2019). *Handbook of human factors in air transportation systems*. CRC Press.	This text was excluded because it was an edited book with multiple contributors, but the authors were recruited to contribute to the book and the chapters were not reprinted from other sources.
Maurino, D.E., Reason, J., Johnston, N., & Lee, R.B. (1995). *Beyond aviation human factors*. Ashgate.	A review of the table of contents and preface shows this text has a different scope. It is written from the organizational viewpoint and contains more case studies than explanations.
Seedhouse, E., Brickhouse, A., Szathmary, and Williams, E.D. (2020). *Human factors in air transport: Understanding behavior and performance in aviation*. Springer.	This text was excluded because the title focused on air transport and the table of contents showed a limited scope. More chapters focused on aviation physiological topics than other key topics.

Wise, J.A., Hopkin, V.D., & Garland, D.J. (2010). *Handbook of aviation human factors (2nd ed.).* CRC Press.	This text was excluded because it was an edited book with multiple contributors, but the authors were recruited to contribute to the book and the chapters were not reprinted from other sources.

Appendix E: First Review November 2022 Results

The first review was conducted in November of 2022. The plan was to review similar chapters from each text so that comparisons between the texts would be easier. The chapters included in this review can be seen in Table E-1.

Table E-1

Chapters included in the First Review

	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Chapter	3, 10	1, 3, 4, 6	3, 4, 5, 6, 7, 8

As can be seen from the chapters covered, it became increasingly difficult to review similar chapters in the texts since the text covered topics differently and not in the same order. The preliminary results (see Table E-2) from this first review demonstrated the importance of carefully identifying synonyms for each subcategory. A coding frame needs to be rigid enough to prevent ambiguity but flexible enough to capture the true essence of each text. This review helped identify areas for improvement in the coding frame, therefore strengthening the reliability and validity.

Table E-2

First review November 2022 results

Subcategory	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Course Catalog Description			
Aviation Physiology	X		X
Human Behavior			X
Error		X	X
Communication		X	X
Team Building		X	
Leadership			

Situation Awareness		X	
Crew Resource Management			
Decision Making	X	X	X
Objectives			
Personal and Professional Development			
Critical Thinking	X	X	X
Written Communication			X
Oral Communication		X	X
Socio-cultural Diversity			X
Leadership			
Professionalism			
Teamwork		X	
Technology			
Ethics			
CRM Curriculum Topics			
Briefings		X	
Inquiry/ Advocacy/ Assertion		X	
Crew Self-Critique			
Conflict Resolution			
Communications and Decision Making			
Leadership/ Followership/ Concern for Task			
Interpersonal Relationships/Group Climate	X		X
Workload Management and Situation Awareness			
Preparation/ Planning/ Vigilance			
Workload Distribution/ Distraction Avoidance			
Individual Factors/ Stress Reduction			
Other Topics			
NOTECHS		X	
Introduction to Human Factors	X		X
Models	X	X	
Threat and Error Management		X	
Safety Culture		X	

Culture	X	X
Aircraft Design/Systems		X

Appendix F: Second Review May 2023 Results

The second review was conducted in May 2023. This review included all chapters from all three texts. It quickly became evident that the updated coding framework from the first review had not successfully accounted for several issues. When the percentage of agreement (see Reliability) for each chapter was compared to the November 2022 findings, issues of unidimensionality, mutual exclusiveness, and saturation were discovered.

Since my coding framework was developed utilizing a concept driven approach, saturation, or the requirement that each code be used at least once, was not as critical (Schreier, 2012, p. 77). Instead, a finding of "no finding" was evidence that a new textbook addressing that topic was necessary.

Unidimensionality is the requirement that each dimension be unique and mutual exclusiveness requires there be clear distinctions between each subcategory within each dimension (Schreier, 2012, p. 71-76). These requirements decrease the complexity of the coding framework while increasing the clarity of the codes. Because I had not clearly defined the codes there were several violations of these two requirements, which along with factors such as fatigue and insufficient discipline (Krippendorf, 2019, p. 281), when conducting the first analysis contributed to the overall low percentages of agreement.

The first change made was to analyze the chapters in a logical order. Previously the approach had been to analyze the chapters that were similar to one another, essentially organizing the analysis by topic. This resulted in a haphazard analysis since the topics did not have a direct corollary in each book, and those topics were not the same chapter numbers. Therefore, the new methodology was to start with the first book and analyze each chapter in order and then move on to the next text and analyze those chapters in order. During this analysis

I made notes on the decision I made that could later be restated as decision rules. The index was used to look-up codes and synonyms to check if anything had been missed. This "by text approach" made it more difficult to compare each similar topic to each other to find similarities and differences and ensure the coding frame was being reliably applied, but it was more organized.

To make comparisons easier, the next step was to create a list of key terms from each similar chapter to find overlapping terms or variations. This allowed the synonym list to be updated and develop a definition and justification for each code to explain what should or should not be included. Schreier (2012) refers to this as "decision rules", which helps minimize the issues associated with mutual exclusiveness and unidimensionality. Further reflection on the notes made allowed for a comparison of each similar chapter to each other, and when a difference in the application of the coding framework was identified, the chapter analysis and the decision rules were updated.

To keep the dimensions as closely related to the concepts they were derived from (i.e., course catalog description or CRM curriculum topics), I could not completely adhere to unidimensionality and mutual exclusiveness. However, the decision rules and clear definitions decreased the negative impact of these violations. I then provided an updated coding framework to my raters. The results from the second analysis are shown in Table F-1.

Table F-1

Second review May 2023 results

Subcategory	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Course Catalog Description			
Aviation Physiology	X	X	X
Human Behavior	X	X	X

Error	X	X	X
Communication		X	X
Team Building		X	X
Leadership	X	X	X
Situation Awareness	X		X
Crew Resource Management	X		
Decision Making	X	X	X
Objectives			
Personal and Professional Development			
Critical Thinking	X	X	X
Written Communication		X	X
Oral Communication		X	X
Socio-cultural Diversity	X	X	X
Leadership	X	X	X
Professionalism			
Teamwork		X	X
Technology	X	X	X
Ethics			
CRM Curriculum Topics			
Briefings		X	
Inquiry/Advocacy/Assertion		X	
Crew Self-Critique (Decisions and Actions)	X		
Conflict Resolution		X	
Communications and Decision Making			
Leadership/Followership/ Concern for Task		X	X
Interpersonal Relationships/Group Climate		X	X
Workload Management and Situation Awareness			
Preparation/Planning/Vigilance			X
Workload Distribution/Distraction Avoidance			
Individual Factors/Stress Reduction	X	X	X
Other Topics			
NOTECHS		X	
Introduction to Human Factors	X	X	X
Models	X	X	X
Threat and Error Management		X	
Safety Culture	X	X	
Culture	X	X	X

Aircraft Design/Systems	X	X	X

Appendix G: Percentage of Agreement between First and Second Review (Text by Dimension)

The tables included in this appendix show the agreement between the first and second review for each subcategory. In the Subcategory Total column, the term "agree" indicates that subcategory was identified in both the first and second reviews. "Added" means that the subcategory was added in the second review, and "removed" shows that it identified in the first review but removed in the second.

The Subcategory Reliability was calculated by counting the number of "agrees", calculating the number of agree+added, and the number of agree+removed. The number of agrees was then divided by the higher number between agree+added and agree-removed. The denominator indicated the highest number of subcategories identified, either in the first or second review. The number format was set to percentage, which provided the percentage of agreement.

Table G-1

Percentage of agreement between the first and second review for Martinussen & Hunter (2018) based on the subcategory

Subcategory	Subcategory Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 1 Added - 0 Removed - 0	100%
Human Behavior	Agree - 0 Added - 0 Removed - 0	
Error	Agree - 0 Added - 0 Removed - 0	
Communication	Agree - 0 Added - 0 Removed - 0	

Team Building	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 0 Added - 0 Removed - 0	
Situation Awareness	Agree - 0 Added - 1 Removed - 0	0%
Crew Resource Management	Agree - 0 Added - 0 Removed - 0	
Decision Making	Agree - 1 Added - 0 Removed - 0	100%
Objectives		
Personal and Professional Development	Agree - 0 Added - 0 Removed - 0	
Critical/Creative Thinking	Agree - 1 Added - 0 Removed - 0	100%
Written Communication	Agree - 0 Added - 0 Removed - 0	
Oral Communication	Agree - 0 Added - 0 Removed - 0	
Socio-cultural Diversity	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 0 Added - 0 Removed - 0	
Professionalism	Agree - 0 Added - 0 Removed - 0	
Teamwork	Agree - 0 Added - 0 Removed - 0	
Technology	Agree - 0 Added - 0 Removed - 0	

Ethics	Agree - 0 Added - 0 Removed - 0	
CRM Curriculum Topics		
Briefings	Agree - 0 Added - 0 Removed - 0	
Inquiry/Advocacy/Assertion	Agree - 0 Added - 0 Removed - 0	
Crew Self-Critique (Decisions and Actions)	Agree - 0 Added - 1 Removed - 0	
Conflict Resolution	Agree - 0 Added - 0 Removed - 0	0%
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	
Leadership/Followership/Concern for Task	Agree - 0 Added - 0 Removed - 0	
Interpersonal Relationships/Group Climate	Agree - 0 Added - 0 Removed - 1	
Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	0%
Preparation/Planning/Vigilance	Agree - 0 Added - 0 Removed - 0	
Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 0 Added - 1 Removed - 0	
Other Topics		
NOTECHS	Agree - 0 Added - 0 Removed - 0	0%
Introduction to Human Factors	Agree - 1 Added - 0 Removed - 0	

Models	Agree - 1 Added - 0 Removed - 0	100%
Threat and Error Management	Agree - 0 Added - 0 Removed - 0	100%
Safety Culture	Agree - 0 Added - 0 Removed - 0	
Culture	Agree - 0 Added - 0 Removed - 0	
Aircraft Design/Systems	Agree - 0 Added - 0 Removed - 0	

Table G-2

Percentage of agreement between the first and second review for Moriarty (2015) based on the subcategory

Subcategory	Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 0 Added - 0 Removed - 0	
Human Behavior	Agree - 0 Added - 0 Removed - 0	
Error	Agree - 2 Added - 0 Removed - 0	100%
Communication	Agree - 1 Added - 0 Removed - 0	100%
Team Building	Agree - 1 Added - 0 Removed - 0	100%
Leadership	Agree - 0 Added - 0 Removed - 0	

Situation Awareness	Agree - 0 Added - 0 Removed - 1	0%
Crew Resource Management	Agree - 0 Added - 0 Removed - 0	
Decision Making	Agree - 1 Added - 0 Removed - 0	100%
Objectives		
Personal and Professional Development	Agree - 0 Added - 0 Removed - 0	
Critical/Creative Thinking	Agree - 1 Added - 0 Removed - 0	100%
Written Communication	Agree - 0 Added - 1 Removed - 0	0%
Oral Communication	Agree - 1 Added - 0 Removed - 0	100%
Socio-cultural Diversity	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 0 Added - 0 Removed - 0	
Professionalism	Agree - 0 Added - 0 Removed - 0	
Teamwork	Agree - 1 Added - 0 Removed - 0	100%
Technology	Agree - 0 Added - 0 Removed - 0	
Ethics	Agree - 0 Added - 0 Removed - 0	
CRM Curriculum Topics		
Briefings	Agree - 1 Added - 0 Removed - 0	100%

Inquiry/Advocacy/Assertion	Agree - 1 Added - 0 Removed - 0	100%
Crew Self-Critique (Decisions and Actions)	Agree - 0 Added - 0 Removed - 0	
Conflict Resolution	Agree - 0 Added - 0 Removed - 0	
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	
Leadership/Followership/Concern for Task	Agree - 0 Added - 0 Removed - 0	
Interpersonal Relationships/Group Climate	Agree - 0 Added - 1 Removed - 0	0%
Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Preparation/Planning/Vigilance	Agree - 0 Added - 0 Removed - 0	
Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 0 Added - 0 Removed - 0	
Other Topics		
NOTECHS	Agree - 1 Added - 0 Removed - 0	100%
Introduction to Human Factors	Agree - 0 Added - 1 Removed - 0	0%
Models	Agree - 1 Added - 1 Removed - 0	50%
Threat and Error Management	Agree - 1 Added - 0 Removed - 0	100%

Safety Culture	Agree - 1 Added - 0 Removed - 0	100%
Culture	Agree - 1 Added - 0 Removed - 0	100%
Aircraft Design/Systems	Agree - 0 Added - 0 Removed - 0	

Table G-3

Percentage of agreement between the first and second review for Orlady & Orlady (1999) based on the subcategory

Subcategory	Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 1 Added - 0 Removed - 0	100%
Human Behavior	Agree - 1 Added - 0 Removed - 0	100%
Error	Agree - 1 Added - 0 Removed - 0	100%
Communication	Agree - 2 Added - 0 Removed - 0	100%
Team Building	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 0 Added - 1 Removed - 0	0%
Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Crew Resource Management	Agree - 0 Added - 0 Removed - 0	

Decision Making	Agree - 1 Added - 0 Removed - 0	100%
Objectives		
Personal and Professional Development	Agree - 0 Added - 0 Removed - 0	
Critical/Creative Thinking	Agree - 1 Added - 0 Removed - 0	100%
Written Communication	Agree - 2 Added - 0 Removed - 0	100%
Oral Communication	Agree - 1 Added - 0 Removed - 0	100%
Socio-cultural Diversity	Agree - 1 Added - 0 Removed - 0	100%
Leadership	Agree - 0 Added - 1 Removed - 0	0%
Professionalism	Agree - 0 Added - 0 Removed - 0	
Teamwork	Agree - 0 Added - 0 Removed - 0	
Technology	Agree - 0 Added - 0 Removed - 0	
Ethics	Agree - 0 Added - 0 Removed - 0	
CRM Curriculum Topics		
Briefings	Agree - 0 Added - 0 Removed - 0	
Inquiry/Advocacy/Assertion	Agree - 0 Added - 0 Removed - 0	
Crew Self-Critique (Decisions and Actions)	Agree - 0 Added - 0 Removed - 0	

Conflict Resolution	Agree - 0 Added - 0 Removed - 0	
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	
Leadership/Followership/Concern for Task	Agree - 0 Added - 1 Removed - 0	0%
Interpersonal Relationships/Group Climate	Agree - 1 Added - 0 Removed - 0	100%
Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Preparation/Planning/Vigilance	Agree - 0 Added - 1 Removed - 0	0%
Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 0 Added - 0 Removed - 0	
Other Topics		
NOTECHS	Agree - 0 Added - 0 Removed - 0	
Introduction to Human Factors	Agree - 1 Added - 0 Removed - 0	100%
Models	Agree - 0 Added - 0 Removed - 0	
Threat and Error Management	Agree - 0 Added - 0 Removed - 0	
Safety Culture	Agree - 0 Added - 0 Removed - 0	
Culture	Agree - 1 Added - 0 Removed - 0	100%

Aircraft Design/Systems	Agree - 1 Added - 0 Removed - 0	100%

Appendix H: Percentage of Agreement between First and Second Review (Chapter by Dimension)

The tables included in this appendix show the agreement between the first and second review for a given text and chapter. Within the Chapter Total row, the term "agree" indicates that subcategory was identified in both the first and second reviews. "Added" means that the subcategory was added in the second review, and "removed" shows that it identified in the first review but removed in the second.

The Chapter Reliability was calculated by counting the number of "agrees", calculating the number of agree+added, and the number of agree+removed. The number of agrees was then divided by the higher number between agree+added and agree-removed.

The denominator indicated the highest number of subcategories identified, either in the first or second review. The number format was set to percentage, which provided the percentage of agreement.

Table H-1

Percentage of agreement between first and second review Martinussen & Hunter (2018) for each chapter based on the dimension.

	Chapter 1	Chapter 3	Chapter 10
	All Dimensions		
Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 1	Agree - 2 Added - 2 Removed - 0
Chapter Reliability	100.00%	50.00%	50.00%
	Course Catalog Description		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 0

Chapter Reliability		100%	50%
	Objectives		
	Agree - 0	Agree - 0	Agree - 1
Chapter Total	Added - 0	Added - 0	Added - 0
	Removed - 0	Removed - 0	Removed - 0
Chapter Reliability			100%
	CRM Curriculum Topics		
	Agree - 0	Agree - 0	Agree - 0
Chapter Total	Added - 0	Added - 1	Added - 1
	Removed - 0	Removed - 1	Removed - 0
Chapter Reliability		0%	0%
	Other Topics		
	Agree - 2	Agree - 0	Agree - 0
Chapter Total	Added - 0	Added - 0	Added - 0
	Removed - 0	Removed - 0	Removed - 0
Chapter Reliability	100%		

Table H-2

Percentage of agreement between first and second review Moriarty (2015) for each chapter based on the dimension.

	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 6
		All Dimensions			
	Agree - 2	Agree - 2	Agree - 2	Agree - 3	Agree - 6
Chapter Total	Added - 1	Added - 0	Added - 1	Added - 0	Added - 2
	Removed - 0	Removed - 1	Removed - 0	Removed - 0	Removed - 0
Chapter Reliability	66.67%	66.67%	66.67%	100.00%	75.00%
		Course Catalog Description			
	Agree - 0	Agree - 1	Agree - 1	Agree - 1	Agree - 2
Total	Added - 0	Added - 0	Added - 0	Added - 0	Added - 0
	Removed - 0	Removed - 1	Removed - 0	Removed - 0	Removed - 0

Chapter Reliability		50%	100%	100%	100%
		Objectives			
Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 1 Removed - 0
Chapter Reliability		100%			67%
		CRM Curriculum Topics			
Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 1 Removed - 0
Chapter Reliability					67%
		Other Topics			
Total	Agree - 2 Added - 1 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Chapter Reliability	67%		50%	100%	

Table H-3

Percentage of agreement between first and second review Orlady & Orlady (1999) for each chapter based on the dimension.

	Chapter 3	Chapter 4	Chapter 5	Chapter 6	Chapter 7	Chapter 8	Chapter 9
			All Dimensions				
Chapter Total	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 4 Added - 3 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 2 Added - 1 Removed - 0	Agree - 3 Added - 0 Removed - 0
Chapter Reliability	100.00%	100.00%	100.00%	57.14%	100.00%	66.67%	100.00%
			Course Catalog Description				

Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Chapter Reliability		100%		50%	100%	100%	100%
			Objectives				
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Chapter Reliability				50%	100%	100%	100%
			CRM Curriculum Topics				
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 1 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 1 Removed - 0	Agree - 0 Added - 0 Removed - 0
Chapter Reliability				50%		0%	
			Other Topics				
Chapter Total	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Chapter Reliability			100%	100%			

Appendix I: Percentage of Agreement between First and Second Review (Text)

The tables included in this appendix show the agreement between the first and second review for a given text. The term "agree" indicates that subcategory was identified in both the first and second reviews. "Added" means that the subcategory was added in the second review and "removed" shows that it identified in the first review but removed in the second.

The reliability was calculated by counting the number of "agrees", calculating the number of agree+added, and the number of agree+removed. The number of agrees was then divided by the higher number between agree+added and agree+removed. The denominator indicated the highest number of subcategories identified, either in the first or second review. The number format was set to percentage, which provided the percentage of agreement.

The "All Dimensions" rows calculate the reliability based on the number of agrees, added, and removed for the chapter and for the text. The Reliability based on the Chapter is the percentage of agreement for the text based on the chapter calculations. This calculation is similar to the reliability for the dimension by chapter calculated in Appendix F, however it includes all dimensions. For this calculation chapters and dimensions can have multiple agree/added/removed, therefore the overall calculation has a higher quantity of each.

The "Reliability based on the Text" is very similar to the reliability calculations based on individual chapters, except this number looks exclusively at each text across all dimensions. It limits each text to just one agree/added/removed for each subcategory of the dimension. Therefore, the calculations are smaller than looking at it by chapter.

If the Reliability by Text value is less than the by chapter calculations (for example Orlady and Orlady (1999) that means the subcategory appears multiple times in the book in

different chapters. By limiting each book to just one instance, the number of added or removed subcategories has an increased impact.

If the Reliability by Text value is higher than the by chapter calculation (for example Moriarty (2015) then the errors that led to adding or removing a subcategory did not have an overall impact on the text's analysis (for example if a subcategory appears in multiple chapters, it may have been identified in one chapter but missed in another leading to an "added" or "removed" label).

Table I-1

Percentage of Agreement between First and Second Review for each text by dimension.

Subcategory	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
	All Dimensions		
Chapter/Text Total	Agree - 5 Added - 3 Removed - 1	Agree - 15 Added - 4 Removed - 1	Agree - 15 Added - 4 Removed - 0
Text Reliability Based on Coding Unit: Chapter	63%	79%	79%
Text Total	Agree - 5 Added - 3 Removed - 1	Agree - 14 Added - 3 Removed - 1	Agree - 13 Added - 4 Removed - 0
Text Reliability Based on Coding Unit: Text	63%	82%	76%
	Course Catalog Description		
Text Total	Agree - 2 Added - 1 Removed - 0	Agree - 4 Added - 0 Removed - 1	Agree - 5 Added - 1 Removed - 0
Text Reliability	67%	80%	83%
	Objectives		
Text Total	Agree - 1 Added - 0 Removed - 0	Agree - 3 Added - 1 Removed - 0	Agree - 4 Added - 1 Removed - 0
Text Reliability	100%	75%	80%
	CRM Curriculum Topics		
Text Total	Agree - 0 Added - 2 Removed - 1	Agree - 0 Added - 1 Removed - 0	Agree - 1 Added - 2 Removed - 0

Text Reliability	0%	67%	33%
	Other Topics		
	Agree - 2	Agree - 5	Agree - 3
Text Total	Added - 0	Added - 1	Added - 0
	Removed - 0	Removed - 0	Removed - 0
Text Reliability	100%	83%	100%

Appendix J: Third and Final Coding Results

Table J-1

Third and final coding results

Subcategory	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Course Catalog Description			
Aviation Physiology	X	X	X
Human Behavior	X	X	X
Error	X	X	X
Communication		X	X
Team Building		X	X
Leadership	X	X	X
Situation Awareness	X		X
Crew Resource Management	X		
Decision Making	X	X	X
Objectives			
Personal and Professional Development			
Critical Thinking	X	X	X
Written Communication		X	X
Oral Communication		X	X
Socio-cultural Diversity	X	X	X
Leadership	X	X	X
Professionalism			
Teamwork		X	X
Technology	X	X	X
Ethics			
CRM Curriculum Topics			
Briefings		X	
Inquiry/Advocacy/Assertion		X	
Crew Self-Critique (Decisions and Actions)	X		
Conflict Resolution		X	
Communications and Decision Making			
Leadership/Followership/Concern for Task		X	X
Interpersonal Relationships/Group Climate		X	X
Workload Management and Situation Awareness			
Preparation/Planning/Vigilance			X
Workload Distribution/Distraction Avoidance			

Individual Factors/Stress Reduction	X	X	X
Other Topics			
NOTECHS		X	
Introduction to Human Factors	X	X	X
Models	X	X	X
Threat and Error Management		X	
Safety Culture	X	X	
Culture	X	X	X
Aircraft Design/Systems	X	X	X

Appendix K: Percentage of Agreement between Second Review and Final Coding (Text by Dimension)

Table K-1

Percentage of agreement between the first and second review for Martinussen & Hunter (2018) based on the subcategory

Subcategory	Subcategory Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 2 Added - 0 Removed - 0	100%
Human Behavior	Agree - 3 Added - 0 Removed - 0	100%
Error	Agree - 1 Added - 0 Removed - 0	100%
Communication	Agree - 0 Added - 0 Removed - 0	
Team Building	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 1 Added - 0 Removed - 0	100%
Situation Awareness	Agree - 1 Added - 0 Removed - 0	100%
Crew Resource Management	Agree - 1 Added - 0 Removed - 0	100%
Decision Making	Agree - 1 Added - 1 Removed - 0	50%
Objectives		
Personal and Professional Development	Total	Subcategory Reliability

Critical/Creative Thinking	Agree - 0 Added - 0 Removed - 0	
Written Communication	Agree - 1 Added - 1 Removed - 0	50%
Oral Communication	Agree - 0 Added - 0 Removed - 0	
Socio-cultural Diversity	Agree - 0 Added - 0 Removed - 0	
Leadership	Agree - 1 Added - 0 Removed - 0	100%
Professionalism	Agree - 1 Added - 0 Removed - 0	100%
Teamwork	Agree - 0 Added - 0 Removed - 0	
Technology	Agree - 0 Added - 0 Removed - 0	
Ethics	Agree - 1 Added - 0 Removed - 0	100%
CRM Curriculum Topics		
Briefings	Agree - 0 Added - 0 Removed - 0	
Inquiry/Advocacy/Assertion	Agree - 0 Added - 0 Removed - 0	
Crew Self-Critique (Decisions and Actions)	Agree - 1 Added - 0 Removed - 0	100%
Conflict Resolution	Agree - 0 Added - 0 Removed - 0	
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	

Leadership/Followership/Concern for Task	Agree - 0 Added - 0 Removed - 0	
Interpersonal Relationships/Group Climate	Agree - 0 Added - 0 Removed - 0	
Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Preparation/Planning/Vigilance	Agree - 0 Added - 0 Removed - 0	
Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 2 Added - 0 Removed - 0	100%
Other Topics		
NOTECHS	Agree - 0 Added - 0 Removed - 0	
Introduction to Human Factors	Agree - 1 Added - 0 Removed - 0	100%
Models	Agree - 1 Added - 0 Removed - 0	100%
Threat and Error Management	Agree - 0 Added - 0 Removed - 0	
Safety Culture	Agree - 1 Added - 0 Removed - 0	100%
Culture	Agree - 1 Added - 0 Removed - 0	100%
Aircraft Design/Systems	Agree - 1 Added - 0 Removed - 0	100%

Table K-2

Percentage of agreement between the second and third review for Moriarty (2015) based on the subcategory

	Subcategory Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 2 Added - 0 Removed - 0	100%
Human Behavior	Agree - 1 Added - 0 Removed - 0	100%
Error	Agree - 2 Added - 0 Removed - 0	100%
Communication	Agree - 1 Added - 0 Removed - 0	100%
Team Building	Agree - 1 Added - 0 Removed - 0	100%
Leadership	Agree - 1 Added - 0 Removed - 0	100%
Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Crew Resource Management	Agree - 0 Added - 0 Removed - 0	
Decision Making	Agree - 1 Added - 0 Removed - 0	100%
Objectives		
Personal and Professional Development	Agree - 0 Added - 0 Removed - 0	
Critical/Creative Thinking	Agree - 1 Added - 0 Removed - 0	100%
Written Communication	Agree - 1 Added - 0 Removed - 0	100%

Oral Communication	Agree - 1 Added - 0 Removed - 0	100%
Socio-cultural Diversity	Agree - 1 Added - 0 Removed - 0	100%
Leadership	Agree - 1 Added - 0 Removed - 0	100%
Professionalism	Agree - 0 Added - 0 Removed - 0	
Teamwork	Agree - 2 Added - 0 Removed - 0	100%
Technology	Agree - 1 Added - 0 Removed - 0	100%
Ethics	Agree - 1 Added - 0 Removed - 0	100%
CRM Curriculum Topics		
Briefings	Agree - 1 Added - 0 Removed - 0	100%
Inquiry/Advocacy/Assertion	Agree - 1 Added - 0 Removed - 0	100%
Crew Self-Critique (Decisions and Actions)	Agree - 0 Added - 0 Removed - 0	
Conflict Resolution	Agree - 1 Added - 0 Removed - 0	100%
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	
Leadership/Followership/Concern for Task	Agree - 1 Added - 0 Removed - 0	100%
Interpersonal Relationships/Group Climate	Agree - 2 Added - 0 Removed - 0	100%

Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Preparation/Planning/Vigilance	Agree - 0 Added - 0 Removed - 0	
Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 2 Added - 0 Removed - 0	100%
Other Topics		
NOTECHS	Agree - 2 Added - 0 Removed - 0	100%
Introduction to Human Factors	Agree - 1 Added - 0 Removed - 0	100%
Models	Agree - 2 Added - 0 Removed - 0	100%
Threat and Error Management	Agree - 1 Added - 0 Removed - 0	100%
Safety Culture	Agree - 1 Added - 0 Removed - 0	100%
Culture	Agree - 2 Added - 0 Removed - 0	100%
Aircraft Design/Systems	Agree - 1 Added - 0 Removed - 0	100%

Table K-3

Percentage of agreement between the second and third review for Orlady & Orlady (1999) based on the subcategory

	Subcategory Total	Subcategory Reliability
Course Catalog Description		

Aviation Physiology	Agree - 3 Added - 0 Removed - 0	100%
Human Behavior	Agree - 2 Added - 0 Removed - 0	100%
Error	Agree - 1 Added - 0 Removed - 0	100%
Communication	Agree - 3 Added - 0 Removed - 0	100%
Team Building	Agree - 1 Added - 0 Removed - 0	100%
Leadership	Agree - 2 Added - 0 Removed - 0	100%
Situation Awareness	Agree - 1 Added - 0 Removed - 0	100%
Crew Resource Management	Agree - 0 Added - 1 Removed - 0	0%
Decision Making	Agree - 1 Added - 0 Removed - 0	100%
Objectives		
Personal and Professional Development	Agree - 0 Added - 0 Removed - 0	
Critical/Creative Thinking	Agree - 1 Added - 0 Removed - 0	100%
Written Communication	Agree - 2 Added - 0 Removed - 0	100%
Oral Communication	Agree - 2 Added - 0 Removed - 0	100%
Socio-cultural Diversity	Agree - 1 Added - 0 Removed - 0	100%

Leadership	Agree - 2 Added - 0 Removed - 0	100%
Professionalism	Agree - 0 Added - 0 Removed - 0	
Teamwork	Agree - 1 Added - 0 Removed - 0	100%
Technology	Agree - 1 Added - 0 Removed - 0	100%
Ethics	Agree - 0 Added - 0 Removed - 0	
CRM Curriculum Topics		
Briefings	Agree - 0 Added - 0 Removed - 0	
Inquiry/Advocacy/Assertion	Agree - 0 Added - 0 Removed - 0	
Crew Self-Critique (Decisions and Actions)	Agree - 0 Added - 0 Removed - 0	
Conflict Resolution	Agree - 0 Added - 0 Removed - 0	
Communications and Decision Making	Agree - 0 Added - 0 Removed - 0	
Leadership/Followership/Concern for Task	Agree - 2 Added - 0 Removed - 0	100%
Interpersonal Relationships/Group Climate	Agree - 2 Added - 0 Removed - 0	100%
Workload Management and Situation Awareness	Agree - 0 Added - 0 Removed - 0	
Preparation/Planning/Vigilance	Agree - 3 Added - 0 Removed - 0	100%

Workload Distribution/Distraction Avoidance	Agree - 0 Added - 0 Removed - 0	
Individual Factors/Stress Reduction	Agree - 1 Added - 0 Removed - 0	100%
Other Topics		
NOTECHS	Agree - 0 Added - 0 Removed - 0	
Introduction to Human Factors	Agree - 2 Added - 0 Removed - 0	100%
Models	Agree - 1 Added - 0 Removed - 0	100%
Threat and Error Management	Agree - 0 Added - 0 Removed - 0	
Safety Culture	Agree - 0 Added - 0 Removed - 0	
Culture	Agree - 1 Added - 0 Removed - 0	100%
Aircraft Design/Systems	Agree - 2 Added - 0 Removed - 0	100%

Appendix L: Percentage of Agreement between Second and Third Review (Chapter by Dimension)

Table L-1

Percentage of agreement between the second and third review for each Martinussen & Hunter (2018) chapter based on the dimension

	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5
			All Dimensions		
Chapter Total	Agree - 2 Added - 2 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	50.00%		100.00%	100.00%	
			Course Catalog Description		
Chapter Total	Agree - 0 Added - 1 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	0%		100%	100%	
			Objectives		
Chapter Total	Agree - 0 Added - 1 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	0%				
			CRM Curriculum Topics		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0

Dimension/ Chapter Reliability			100%		
			Other Topics		
Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%				

Table L.1 (cont.)

Percentage of agreement between the second and third review for each Martinussen & Hunter (2018) chapter based on the dimension

	Chapter 6	Chapter 7	Chapter 8	Chapter 9	Chapter 10
			All Dimensions		
Chapter Total	Agree - 1 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 6 Added - 0 Removed - 0	Agree - 2 Added - 2 Removed - 0
Dimension/ Chapter Reliability	100.00%	100.00%	100.00%	100.00%	100.00%
			Course Catalog Description		
Chapter Total	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%	100%	100%	100%
			Objectives		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0

Dimension/ Chapter Reliability		100%		100%	100%
		CRM Curriculum Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability			100%		100%
		Other Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability		100%		100%	

Table L-2

Percentage of agreement between the second and third review for each Moriarty (2015) chapter based on the dimension

	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5
		All Dimensions			
Chapter Total	Agree - 3 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 10 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100.00%	100.00%	100.00%	100.00%	100.00%
		Course Catalog Description			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%			

			Objectives		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0
Dimension/ Chapter Reliability		100%			100%
			CRM Curriculum Topics		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0
Dimension/ Chapter Reliability					100%
			Other Topics		
Chapter Total	Agree - 3 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%		100%	100%	100%

Table L-3

Percentage of agreement between the second and third review for each Moriarty (2015) chapter based on the dimension

	Chapter 6	Chapter 7	Chapter 8	Chapter 9
		All Dimensions		
Chapter Total	Agree - 8 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100.00%	100.00%	100.00%	100.00%
		Course Catalog Description		

Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability				100%
		Objectives		
Chapter Total	Agree - 3 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%			100%
		CRM Curriculum Topics		
Chapter Total	Agree - 3 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%	100%	
		Other Topics		
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability				100%

Table L-4

Percentage of agreement between the second and third review for each Orlady and Orlady (1999) chapter based on the dimension

	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6
All Dimensions						

Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 7 Added - 0 Removed - 0
Dimension/ Chapter Reliability			100.00%	100.00%	100.00%	100.00%
			Course Catalog Description			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%	100%	100%	100%	
			Objectives			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability						100%
			CRM Curriculum Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability						100%
			Other Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability			100%		100%	100%

Table L-5

Percentage of agreement between the second and third review for each Orlady and Orlady (1999) chapter based on the dimension

	Chapter 7	Chapter 8	Chapter 9	Chapter 10	Chapter 11	Chapter 12
			All Dimensions			

Chapter Total	Agree - 3 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100.00%	100.00%	100.00%		100.00%	100.00%
			Course Catalog Description			
Chapter Total	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability						
			Objectives			
Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%	100%		100%	
			CRM Curriculum Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability		100%				100%
			Other Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability					100%	

Table L-6

Percentage of agreement between the second and third review for each Orlady and Orlady (1999) chapter based on the dimension

	Chapter 13	Chapter 14	Chapter 15	Chapter 16	Chapter 17
			All Dimensions		

Chapter Total	Agree - 6 Added - 1 Removed - 0	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 3 Added - 0 Removed - 0
Dimension/ Chapter Reliability	85.71%	100.00%	100.00%	100.00%	100.00%
		Course Catalog Description			
Chapter Total	Agree - 2 Added - 1 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability			100%		100%
		Objectives			
Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%				100%
		CRM Curriculum Topics			
Chapter Total	Agree - 2 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%			100%
		Other Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability					

Table L-7

Percentage of agreement between the second and third review for each Orlady and Orlady (1999) chapter based on the dimension

	Chapter 18	Chapter 19	Chapter 20	Chapter 21	Chapter 22
		All Dimensions			

Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability		100.00%	100.00%		
		Course Catalog Description			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability	100%	100%	100%		
		Objectives			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability					
		CRM Curriculum Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability					
		Other Topics			
Chapter Total	Agree - 0 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 1 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0	Agree - 0 Added - 0 Removed - 0
Dimension/ Chapter Reliability		100%	100%		

Appendix M: Percentage of Agreement between Second and Third Review (Text)

Table M-1

Percentage of agreement between the second and third review for Orlady and Orlady (1999) based on the dimension

Subcategory	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
	All Dimensions		
All Chapter/Text Total	Agree - 10 Added - 1 Removed - 0	Agree - 12 Added - 0 Removed - 0	Agree - 38 Added - 1 Removed - 0
Text Reliability Based on Coding Unit: All Chapters	100%	100%	100.00%
Text Total	Agree - 18 Added - 0 Removed - 0	Agree - 27 Added - 0 Removed - 0	Agree - 23 Added - 1 Removed - 0
Text Reliability Based on Coding Unit: Text	100.00%	100.00%	95.45%
	Course Catalog Description		
Dimension/Text Total	Agree - 7 Added - 0 Removed - 0	Agree - 7 Added - 0 Removed - 0	Agree - 8 Added - 1 Removed - 0
Dimension/Text Reliability	100%	100%	89%
	Objectives		
Dimension/Text Total	Agree - 4 Added - 0 Removed - 0	Agree - 7 Added - 0 Removed - 0	Agree - 7 Added - 0 Removed - 0
Dimension/Text Reliability	100%	100%	100%
	CRM Curriculum Topics		
CRM /Text Total	Agree - 3 Added - 0 Removed - 0	Agree - 8 Added - 0 Removed - 0	Agree - 8 Added - 0 Removed - 0
CRM/Text Reliability	100%	100%	100%
	Other Topics		
Other Topics /Text Total	Agree - 5 Added - 0 Removed - 0	Agree - 7 Added - 0 Removed - 0	Agree - 4 Added - 0 Removed - 0
Other Topics/Text Reliability	100%	100%	100%

Appendix N: Pedagogical Aids

Table N-1

Pedagogical aids identified in each text

Pedagogical Aid	Martinussen & Hunter (2018)	Moriarty (2015)	Orlady & Orlady (1999)
Chapter Objectives			
Chapter Outline		X	
Key Terms Identified			
Key points/Summary		X	
Review/Discussion Questions			

Appendix O: Rater Findings and Percentage of Agreement

Table O-1

Rater Findings

Subcategory	Moriarty (2015)
Course Catalog Description	
Aviation Physiology	X
Human Behavior	X
Communication	X
Leadership	X
Decision Making	X
Objectives	
Personal and Professional Development	X
Oral Communication	X
Professionalism	X
Teamwork	X
CRM Curriculum Topics	
Conflict Resolution	X
Interpersonal Relationships/Group Climate	X
Individual Factors/Stress Reduction	X
Other Topics	
Culture	X

Note: In the four chapters reviewed, 5, 6, 7, and 8, the rater did not identify Course Catalog description subcategories Error, Situation Awareness, Teambuilding, or Crew Resource Management, Objectives subcategories Critical Thinking, Written communication, Sociocultural Diversity, Technology, or Ethics, CRM Curriculum Topics Briefings, Inquiry/Advocacy/Assertion, Crew Self-Critique (Decisions and Actions), Communications and Decision Making, Leadership/Followership/Concern for Task, Workload Management and Situation Awareness, Preparation/Planning/Vigilance, Workload Distribution/Distraction Avoidance, or Individual Factors/Stress Reduction and Other Topics NOTECHS, Introduction to Human Factors, Models, Threat and Error Management, Safety Culture, or Aircraft Design/Systems.

Table O-2

Percentage of Agreement by chapter

Moriarty (2015)	Chapter 5	Chapter 6	Chapter 7	Chapter 8
All Dimensions				
Chapter Total	Agree - 6 Included - 1 Excluded - 1	Agree - 4 Included - 3 Excluded - 4	Agree - 4 Included - 2 Excluded - 1	Agree - 2 Included - 1 Excluded - 0

Dimension/ Chapter Reliability	85.71%	50.00%	66.67%	66.67%
Course Catalog Description				
Chapter Total	Agree - 2 Included – 0 Excluded - 0	Agree - 1 Included – 1 Excluded - 1	Agree - 1 Included – 2 Excluded - 0	Agree - 1 Included – 1 Excluded - 0
Dimension/ Chapter Reliability	100%	50%	33%	50%
Objectives				
Chapter Total	Agree - 1 Excluded - 2 Included - 2	Agree - 2 Excluded - 1 Included - 0	Agree - 0 Excluded - 0 Included - 0	Agree - 0 Excluded - 0 Included - 1
Dimension/ Chapter Reliability	33%	67%		0%
CRM Curriculum Topics				
Chapter Total	Agree - 2 Included - 1 Excluded - 1	Agree - 2 Included - 0 Excluded - 1	Agree - 1 Included - 0 Excluded - 0	Agree - 1 Included - 0 Excluded - 0
Dimension/ Chapter Reliability	67%	67%	100%	100%
Other Topics				
Chapter Total	Agree - 2 Included - 0 Excluded - 0	Agree - 0 Included - 0 Excluded - 0	Agree - 0 Included - 0 Excluded - 0	Agree - 0 Included - 0 Excluded - 0
Dimension/ Chapter Reliability	100%			

Table O-3

Percentage of Agreement by Domain

Moriarty (2015)	Subcategory Total	Subcategory Reliability
Course Catalog Description		
Aviation Physiology	Agree - 2 Excluded - 0 Included - 0	100%
Human Behavior	Agree - 1 Excluded - 0 Included - 3	25%
Error	Agree - 0 Excluded - 0 Included - 0	

Communication	Agree - 1 Excluded - 0 Included - 0	100%
Team Building	Agree - 0 Excluded - 1 Included - 0	0%
Leadership	Agree - 1 Excluded - 0 Included - 0	100%
Situation Awareness	Agree - 0 Excluded - 0 Included - 0	
Crew Resource Management	Agree - 0 Excluded - 0 Included - 0	
Decision Making	Agree - 0 Excluded - 0 Included - 1	0%

Objectives

Personal and Professional Development	Agree - 0 Excluded - 0 Included - 2	0%
Critical/Creative Thinking	Agree - 0 Excluded - 0 Included - 0	
Written Communication	Agree - 0 Excluded - 1 Included - 0	0%
Oral Communication	Agree - 1 Excluded - 0 Included - 0	100%
Socio-cultural Diversity	Agree - 0 Excluded - 1 Included - 0	0%
Leadership	Agree - 1 Excluded - 0 Included - 0	100%
Professionalism	Agree - 0 Excluded - 0 Included - 1	0%
Teamwork	Agree - 1 Excluded - 1 Included - 0	50%

Technology	Agree - 0 Excluded - 0 Included - 0	
Ethics	Agree - 0 Excluded - 0 Included - 0	
CRM Curriculum Topics		
Briefings	Agree - 1 Included - 0 Excluded - 1	100%
Inquiry/Advocacy/Assertion	Agree - 1 Included - 1 Excluded - 0	50%
Crew Self-Critique (Decisions and Actions)	Agree - 0 Included - 0 Excluded - 0	
Conflict Resolution	Agree - 1 Included - 0 Excluded - 0	100%
Communications and Decision Making	Agree - 0 Included - 0 Excluded - 0	
Leadership/Followership/Concern for Task	Agree - 0 Included - 0 Excluded - 1	0%
Interpersonal Relationships/Group Climate	Agree - 1 Included - 0 Excluded - 1	50%
Workload Management and Situation Awareness	Agree - 0 Included - 0 Excluded - 0	
Preparation/Planning/Vigilance	Agree - 0 Included - 0 Excluded - 0	
Workload Distribution/Distraction Avoidance	Agree - 0 Included - 0 Excluded - 0	
Individual Factors/Stress Reduction	Agree - 2 Included - 0 Excluded - 0	100%
Other Topics		
NOTECHS	Agree - 1 Included - 0 Excluded - 0	100%

Introduction to Human Factors	Agree - 0 Included - 0 Excluded - 0	
Models	Agree - 0 Included - 0 Excluded - 0	
Threat and Error Management	Agree - 0 Included - 0 Excluded - 0	
Safety Culture	Agree - 0 Included - 0 Excluded - 0	
Culture	Agree - 1 Included - 0 Excluded - 0	100%
Aircraft Design/Systems	Agree - 0 Included - 0 Excluded - 0	

Text reliability

All Dimensions	
Common Chapters/Text Total	Agree - 5 Included - 4 Excluded - 1
Text Reliability Based on Coding Unit: Common Chapters	56%
Text Total	Agree - 4 Included - 1 Excluded - 1
Text Reliability Based on Coding Unit: Text (for common chapters)	80%
Course Catalog Description	
Dimension/Text Total	Agree - 4 Included - 1 Excluded - 1
Dimension/Text Reliability	80%
Objectives	
Dimension/Text Total	Agree - 3 Excluded - 2 Included - 2
Dimension/Text Reliability	60%
CRM Curriculum Topics	

CRM /Text Total		Agree - 2 Included - 3 Excluded - 2
CRM/Text Reliability		40%
	Other Topics	
Other Topics /Text Total		Agree - 2 Included - 0 Excluded - 0
Other Topics/Text Reliability		100%

Rater's Explanation of Decisions Made

Book: Moriarty, D. (2015). Practical human factors for pilots. Academic Press.

Chapter 5: Personality, leadership and teamwork

Category	Descriptor	Rationale
Description 1	Human Behavior	The chapter includes topics that explain why people do what they do. The chapter describes why people act in certain ways in terms of leadership, discusses specific personality types (FFM and NEO-PI-R are described and used as applied examples), and how to work with certain personalities to a lesser extent.
Description 2	Leadership	The discussion includes understanding or improving leadership. The chapter describes how people act in certain ways in terms of leadership, discusses specific personality types, and how to work with certain personalities from a leadership perspective.

Objective 1	Personal and Professional Development	The chapter includes the knowledge and skills to understand the importance of and participate in self-improvement. There are aspects of self-reflection to a lesser extent, especially if the student reads a section and ponders what they would do in the described example.
Objective 2	Professionalism	The text includes discussion of professional conduct and how to build professionalism through discussion on human behavior and leadership.
Objective 3	Leadership approaches	The text gives a brief explanation of leadership approaches with examples.
CRM 1	Interpersonal Relationships/Group Climate	The text gives examples of good leadership, working with toxic personalities, and working with authority figures. The text brings behavior and teamwork topics together in examples and discussion.
CRM 2	Conflict Resolution	A section discusses conflict-solving strategies for individual differences and situational variables. The text brings behavior and teamwork topics together in examples and discussion.
CRM3	Inquiry/Advocacy/ Assertion	The text discusses how pilots can communicate "advocating the course of action that they feel is best,

		even though it may involve conflict with others" as a captain or FO.
Other Topic 1	Culture	A section discusses flight deck culture, how it impacts behavior, and ways to work with issues.
Other Topic 2	NOTECHS	There are references to NOTECHS frameworks/ leadership etc. in the context of NOTECHS.

All key terms came from the provided document. They were chosen if they were defined, discussed specifically, or if the text was obviously relevant to the term without much critical thinking.

Chapter 6: Communication

Category	Descriptor	Rationale
Description 1	Communication	The chapter discussed how to improve, understand, or utilize communication. Communication models were introduced and used in examples.
Description 2	Human Behavior	The chapter described communication as it pertains to why people do what they do, and how to work with people when communication becomes hard/toxic.
Objective 1	Oral Communication	The chapter discussed how to improve, understand, or utilize oral communication, mainly on the flight deck.
Objective 2	Teamwork	The chapter discusses barriers to communication, working with
CRM 1	Communications and Decision Making	The chapter discusses communication as part of the decision-making process, including FO assertiveness at three levels of unsafe/undesired flight.
CRM2	Briefings	There is a section on NITS briefings.
CRM3	Inquiry/Advocacy/ Assertion	The text discusses how pilots can communicate “advocating the course of

		action that they feel is best, even though it may involve conflict with others" as a captain or FO.

Written communication was alluded to, but not specifically discussed. It was not included in the key terms.

All key terms came from the provided document. They were chosen if they were defined, discussed specifically, or if the text was obviously relevant to the term without much critical thinking.

Chapter 7: Fatigue risk management

Category	Descriptor	Rationale
Description 1	Aviation Physiology	The chapter discusses how sleep and fatigue impact the health of the person and their subsequent performance.
Description 2	Human Behavior	The chapter discusses how sleep and fatigue impact human behavior, especially from a brain health/neurological perspective.
Description 3	Decision Making	The chapter discusses how sleep and fatigue impact decision making.
CRM 1	Individual Factors/Stress Reduction	The chapter discusses how sleep and fatigue impact health, how to make the most of sleep and rest to be a better pilot, and offer solutions to maintain one's health.

There were no objectives that fit this chapter, according to their definition in the provided document.

Two key terms for this chapter were recommended by the reviewer, and did not come from the provided document. For example, "sleep stages" was used as opposed to "sleep" to denote that a model was being discussed specifically, and not just sleep in general. This follows other key terms that differentiated between the general and the specific (i.e., "Communication" and "Communication Models"). "Brain health" was added to differentiate from "mental health",

where “brain health” implies neurological functions from a clinical standpoint as opposed to the psychological/psychiatric standpoint implied by “mental health.” If “mental health” is supposed to encompass all functions of the brain, then the key term could be changed. “Medications” was added because the text discussed specific medical options that did no really align with the “Diet and Nutrition” key term; however, “medications” may very well align with the “diet and nutrition” key term, and the rater may be too pedantic.

Chapter 8: Stress management and alcohol

Category	Descriptor	Rationale
Description 1	Aviation Physiology	The chapter discusses how alcohol and stress relate to the health of the person and their health's impact on performance using facts and figures.
Description 2	Human Behavior	The chapter discusses how alcohol and stress impact why people do what they do using broad and specific examples of human behavior.
Objective 1	Personal and Professional Development	The chapter relates the impact/management of stress and the intake of alcohol to knowledge and skills related to the importance of and participate in self-reflection and self-improvement. This is more abstract than specific denoted.
CRM 1	Individual Factors/Stress Reduction	The text specifically discusses stress with an emphasis on performance.

All key terms came from the provided document. They were chosen if they were defined, discussed specifically, or if the text was obviously relevant to the term without much critical thinking.