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**Assessment of Aerospace and
Operational Medicine Enterprise
(AOME) Distance Learning Courses at
The USAF School of Aerospace Medicine**



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14. ABSTRACT To ensure the continuation of its aerospace medicine training mission, the arrival of COVID-19 forced the United States Air Force School of Aerospace Medicine (USAFSAM) to rapidly move its courses from the in-person to online teaching environment. This project was designed to answer (1) are USAFSAM AOME distance learning course outcomes equivalent or superior to courses offered in an in-person format and (2) what lessons can be used to guide future distance learning courses? We found that 44 percent the 61 USAFSAM courses evaluated could be converted to an online environment and 34 percent fit a blended model (in-person with an online component). We converted two courses for an education intervention and found that end of course survey items indicated our online course delivery was equivalent to the in-person course. We estimated a savings of approximately of \$100,000 per BLAST class (\$1.5 million annually) and \$40,000 per BIC class (\$400,000 annually). From the best practices analysis, we learned that instruction in the online environment must be intentionally designed and that online courses with asynchronous material require active participation from the instructor and students. Instructor and student engagement is key to the success of online courses.					
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1.0 SUMMARY

1.2 Background

The arrival of the coronavirus disease (COVID-19) pandemic forced the United States Air Force School of Aerospace Medicine (USAFSAM) to rapidly change its teaching delivery method to meet the needs of the Air Force. As a primarily in-person training institute, the schoolhouse was pushed to rapidly convert courses to the online environment to accomplish its mission.

1.3 Specific Aims

This study was designed to answer the questions: After providing faculty and staff development and establishing an environment conducive for distance learning, (a) are USAFSAM AOME distance learning course outcomes equivalent or superior to courses offered in an in-person format and (b) what lessons can be used to guide future distance learning courses? To answer these questions, we conducted an education intervention with four major aims: 1) to evaluate which USAFSAM courses were conducive for the online environment, 2) determine if there was a difference in student end of course evaluations for the in-person versus online versions of two courses offerings (BIC and BLAST), 3) uncover the cost to convert courses to the online environment, and 4) collect and report lessons learned that could be used to guide future distance learning courses.

1.4 Methods

To meet aims 1 and 2, a pre/post educational intervention design was used. Using existing curriculum plans, instructional design and curriculum development experts evaluated 61 USAFSAM courses for suitability in the online or hybrid environments. We then re-designed and implemented our Basic Instructor Course (BIC) and Basic Leadership Airman Skills Training (BLAST) Course using evidence from the literature and the Analysis, Design, Develop, Implement, Evaluate (ADDIE) model. Student satisfaction for each course from the two training delivery methods (in-person and online) was determined using end of course surveys. The Mann-Whitney U test was used to identify differences between pre/post course conversions. To meet aim 3, we compared the cost to execute the previous in-residence versions of BIC and BLAST against the cost to implement the online pilot. Lastly, to meet aim 4, we collected and reported best practices from a literature review, the course conversion process, and efforts used to build an environment conducive to distance learning.

1.5 Results

We found that 44 percent the 61 USAFSAM courses evaluated could be converted to an online environment and 34 percent fit a blended model (in-person with an online component). Twenty-one percent of courses were found to not be suitable for online delivery. We were able to convert two courses with our education intervention and found that our online course delivery was equivalent to the in-person course in terms of survey items for end of course surveys. Compared to the in-person course version of BLAST (n=17), students also reported statistically higher satisfaction scores for online delivery (n=16) in 15 of the 17 areas surveyed. Examples included greater satisfaction online with course materials being clearly explained (M=5.74, SD 0.11, p<0.001), instructors encouraged student participation (M=5.79, SD 0.14, p=0.008), instructors providing opportunities to answer questions (M=5.87, SD 0.10, p=0.001), and instructors

addressing students' academic questions (M=5.82, SD 0.10, p=0.004). Students taking the online course also reported a statistically significant higher agreement with the phrase "I am confident that I can perform the tasks required by my career field based on what I learned" (M=5.52 online versus M=5.234, p=0.025) and "the course met my expectations" (M=5.58 online versus M = 5.28, p=0.006). Students reported statistically lower satisfaction scores in equipment operating conditions (M=5.58, SD 0.14, p=0.037). There was no significant difference in satisfaction for the support of training aids between in-person and online versions (p=0.168). Due to small sample size from BIC for in-person (n=2) and online (n=5), inferential statistical tests were not performed on BIC. We estimated a savings of approximately of \$100,000 per BLAST class (\$1.5 million annually) and \$40,000 per BIC class (\$400,000 annually). From the best practices analysis, we learned that instruction in the online environment must be intentionally designed and that online courses with asynchronous material require active participation from the instructor and students. Instructor and student engagement is key to the success of online courses.

1.6 Conclusion

USAFSAM's first rapid transition to online learning was successful. We identified best practices, successfully re-designed two courses, and reported on cost savings and lessons learned. We recommend all faculty take the Effective Online Instructor course to familiarize themselves with multi-media tools and asynchronous teaching strategies to maximize student engagement. Future research should focus on modifiable student and instructor characteristics that contribute to successful online learning and identifying best online teaching methodologies and ways to extend our interactive media options. Future research should also focus on developing validated survey instruments to accurately measure student satisfaction over time for each course delivery method.

2.0 INTRODUCTION

The requirement to mask and maintain adequate social distance to decrease the spread of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) directly impacted 4,234 higher education institutions (Kelly, 2020). At least 1,100 academic, medical, and military institutions canceled in-person classes and rapidly transitioned to an online learning environment to continue educating their constituents (Smalley, 2021).

In response to COVID-19, the Office of the Dean and USAFSAM leaders have undertaken a course of action to maximize distance learning to reduce the likely risk of SARS-CoV-2 transmission to faculty, students, and staff. The transition from face-to-face instruction to online learning began at an accelerated rate. Online learning takes the form of either fully on-line teaching or teaching in a blended environment using a combination of on-line and in-person student experiences. However, the transition from face-to-face to online learning involves more than posting PowerPoint slides to a learning management system.

Transitioning USAFSAM courses from predominately face-to-face to distance learning is a challenging but essential piece of meeting the needs of Airmen, Department of Defense civilians, their home units, and the Air Force in today's technology enhanced educational climate. Special training is required to ensure faculty are prepared and proficient at teaching in a distance learning environment. The "methods for faculty training range from formal certification courses and faculty development programs to informal mentoring and on-the-job training" (Gurley, 2018). This training is necessary for faculty to engage in a successful redesign of online courses which "requires educators to thoughtfully and intentionally select course content, design learning activities and design evaluation activities" for online delivery (Gurley, 2018).

When converting a face-to-face course to delivery via online learning, instructors must completely reevaluate the course. Modifications must be made to develop appropriate and applicable learning activities for a distance learning environment. Instructors must also identify areas where social presence and instructor presence can be integrated into the learning activities to help the learning feel authentic to the student (Kampov-Polevoi, 2010). Effective distance learning educators must complete a timely review of discussion posts and completed assignments to provide substantive feedback that engages students in obtaining a deeper understanding of the content. Research has shown online teaching requires more time and effort than face-to-face teaching with instructors spending an average of "12.69 hours per week per online course they teach" (Mandernach et al., 2007; Mandernach and Holbeck, 2016).

Finally, faculty must be provided the technology and digital learning platforms needed to support teaching in a distance learning environment. With distance learning, "educators have many responsibilities in the use of this technology, and many programs that use technology in distance education are ineffective because instructors [may] lack the technical knowledge for employing this technology correctly" (Alharthi, 2020). Therefore, careful consideration and evaluation is necessary to provide the technology needed for USAFSAM instructors and staff to successfully pivot from face-to face to distance learning.

We designed a study to rapidly convert and evaluate the conversion of USAFSAM's BIC and BLAST courses. We aimed to 1) determine if there was a difference in student end of course

evaluations for two different courses offerings (BIC and BLAST) for two teaching delivery types online learning course outcomes, and 2) report lessons learned that could be used to guide future distance learning courses. Our findings are expected to inform academic settings about successful in-person to online course conversion practices and guide future research in this area.

3.0 METHODS, ASSUMPTIONS, and PROCEDURES

3.1 Methodology

We conducted an evaluation of 61 USAFSAM courses for applicability in the online environment (aim 1). Two of these courses were re-designed and implemented the BIC and BLAST courses using evidence from the literature and the ADDIE model. We then conducted a pre-post education intervention at USAFSAM to compare student satisfaction before and after the course conversions to the online environment (aim 2). Following the intervention, we performed a cost analysis on the in-person versus online version of the two courses (aim 3). Finally, we conducted multiple team meeting with our lead principal investigator, associate investigator, two curriculum designers, and our division chief in charge of the budget at the end of the study to discuss lessons learned from the project and the literature (aim 4). A human subjects research exemption was obtained from the Air Force Research Laboratory's Institutional Review Board (IRB).

3.2 Course Evaluation for the Online Environment Methodology

The team evaluated 61 courses to determine suitability in the online environment while maintaining academic rigor and student engagement. The course evaluation process consisted of reviewing the current delivery model, Course Training Standard (CTS), Education Plan, Agenda, and Plan of Instruction (POI). The team also evaluated the Skills, Knowledge, and Attitudes (SKA) to determine their suitability and feasibility for online delivery. Following the online course conversions and course evaluations we met as a research team to reflect on lessons learned throughout the process.

3.3 Conceptual Design Methodology

We redesigned two courses using the ADDIE model and best practices identified in the literature. The ADDIE model represents a 5-phase process used by instructional designers to create and evaluate courses (Air Force Handbook 36-2235, 2002).

In phase 1, analysis, the instructional designer analyzes the job requirements and compares them with the incoming students' skills, knowledge, and abilities (Air Force Handbook 36-2235, 2002). The designer is examining what the student already knows and what the job requires. This gap is the basis for designing the necessary instruction.

Next, in phase 2, the instructional designer begins to design the course. They develop a plan of instruction and determine the instructional strategies needed. In the following phase, the student and instructor lesson materials are developed. Multi-media tools that were selected in phase 2 are further developed in this phase. During this phase, instructional designers validate all the instruction and the associated instructional materials (Air Force Handbook 36-2235, 2002).

Phase 4 of the ADDIE model is centered around implementing the course and phase 5 is focused on a continuous process of evaluation.

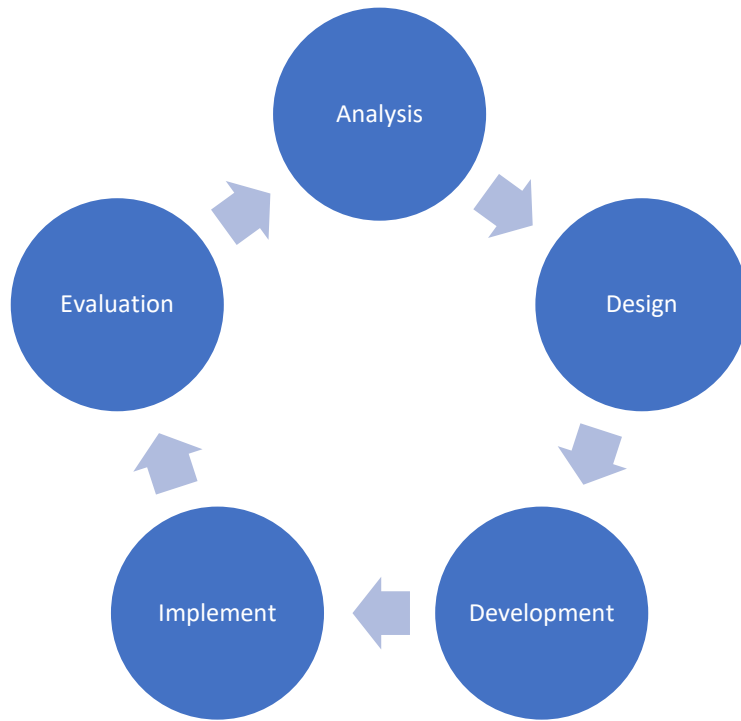


Figure 1. ADDIE model

3.4 Literature Review

The search strategy was aimed at identifying peer-reviewed articles that discussed online learning best practices using six databases: Academic Search Ultimate, Web of Science, ProQuest, Google Scholar, Remote Learning, and PubMed. The initial search was conducted from October to November 2021 and limited to the last ten years.

The following search terms were used: best practices and e-learning; on-line learning; hybrid learning; asynchronous learning; synchronous learning; on-line class; blended learning; distance learning; or remote learning. Articles were included in the review if they discussed online course development, transition, or best practices. Articles were excluded if they only focused on blended, hybrid, e-learning, or remote learning.

A total of 20 articles met the inclusion criteria and were included in this study. Five additional articles were identified in December 2022 through bibliography reviews.

3.5 Course Conversion Process for BLAST and BIC Courses

Armed with the knowledge gained from the literature on best practices and our course suitability analysis, we chose to convert two courses using the ADDIE instructional design model. We

conducted task and learning analyses to understand the course learning objectives, needs of our learners and, knowledge assessment methods. We then re-designed the courses using a combination of synchronous and asynchronous methodologies within our learning management system, Blackboard. Interactive media such as Kahoots quizzes, whiteboards, word clouds, discussion boards, blogs, videos, and PowerPoint presentations were added throughout the course to increase student engagement.

The BLAST course aims to develop leadership, teach the principals of ready, reliable care, and various management/medical readiness topics. Before the conversion, the course was five days in residence and primarily consisted of didactic instruction of 39 lessons and small group exercises. After performing the evaluation of the course and determining that it was suitable for the online environment, BLAST was converted to a five-day hybrid online course with 21 lessons using both synchronous and asynchronous course delivery. The didactic lectures were redesigned into asynchronous modules using the flipped classroom delivery model that requires the students to engage in the materials independently, followed by synchronous sessions where the instructors facilitated group discussions to engage with the students, encourage social presence, and create a collaborative environment where the students can share their unique experiences and best practices related to the material. The small group exercises were converted to instructor-facilitated synchronous online break-out rooms to ensure academic rigor and repeatability.

The goal of the USAFSAM Basic Instructor Course is to train personnel who have been selected to instruct USAFSAM training courses. BIC is a foundational course providing the knowledge and skills required for USAFSAM instructor duty. Before the conversion, BIC was 20 days in residence and primarily consisted of didactic instruction of 29 lessons, three formal written assessments, and five performance-based tests. After performing the evaluation of the course and determining that it was suitable for the online environment, BIC was converted to a 10-day hybrid online course with 16 lessons using both synchronous and asynchronous course delivery. The didactic lectures were redesigned into asynchronous modules using the flipped classroom model for students to engage in the materials independently, followed by synchronous sessions where the instructors summarized the material in the asynchronous modules and instructor-led group discussions to engage with the students and encourage social presence. The formal written tests were eliminated and replaced by daily knowledge checks to assess the student's retention of the asynchronous materials. The performance tests were redeveloped so that the students could still gain experience and get face-to-face instructional delivery feedback.

From there, we implemented changes in the BLAST and BIC courses and evaluated them after the change using end of course surveys.

3.6 Measures and Data Analysis

We analyzed student satisfaction, both before and after transitioning to the online environment, using aggregate grouped data from the standard end of course survey used for all USAFSAM courses. The survey was initially developed by USAFSAM course instructors prior to the COVID-19 pandemic. It consisted of 17 items, which students rated from 1 (strongly disagree) to 6 (strongly agree). Questions were based on the level of agreement with topics including lesson objectives, course content, training aids and materials, equipment, instructor performance, assessments, and course expectations (see Appendix B). Participants were able to skip questions. The survey was administered via Survey Monkey and coded anonymously. If students did not

respond to all items in the survey, their results were not included in the analyses, leading to a different sample size for pre- and post-analysis.

Data were analyzed to compare before and after satisfaction scores and Mann-Whitney U tests to identify differences between pre/post course conversions from in-person to online delivery. Statistical significance was set to $p < 0.05$. No demographic data was available for analysis.

3.7 Assumptions

The outcomes of this research reflect only those students who responded to all 17 items of the survey. This research assumes that graduates provided honest feedback on end of course surveys.

4.0 RESULTS AND DISCUSSION

4.1 Results

4.1.1 Evaluation of Online/Blended Fit for All Courses. We evaluated 61 courses in the USAFSAM course catalog to determine if they could be transitioned to the online environment. We found that 11 courses were already being conducted online and only 13 (21.3%) were not suitable for the online environment in any capacity. Although we were not able to transition all courses to the online environment completely, most courses (N= 37, 60.7%) could be designed to include an online component or were already being taught online (N=11, 18%). Courses with lecture material that did not require in-classroom equipment or direct help from the faculty were the best fit (see Table 1).

Table 1. Evaluation of Online/Blended Fit for All Courses

	Online Fit N (%)	Blended Fit N (%)	Continue Face- to-Face N (%)	Continue Online N (%)
All Courses	16 (26.2)	21 (34.4)	13 (21.3)	11 (18.0)

We also examined suitability for the online environment by department. All the faculty development courses owned by the Office of the Dean were suitable for the online environment. However, no courses under the En Route Care department could transition completely to online course delivery due to the subject matter of their curriculum. However, half of the en route care courses could be designed for the blended environment with online and in-person instruction working together. The remaining departments were able to move many courses online or to a blended environment (see Table 2).

Table 2. Evaluation of Online/Blended Fit for All Courses by Department

Department	Online Fit N (%)	Blended Fit N (%)	Continue Face- to-Face N (%)	Continue Online N (%)
Office of the Dean	4 (100)	0 (0)	0 (0)	0 (0)
En Route Care	0 (0)	5 (50)	5 (50)	0 (0)
Aerospace & Physiology Medicine	4 (18.2)	11 (50)	4 (18.2)	3 (13.6)
Occupational & Environmental Medicine	4 (30.8)	2 (15.4)	2 (15.4)	5 (38.5)
Public Health & Preventive Medicine	5 (41.7)	3 (25)	2 (16.7)	2 (16.7)

4.1.2 Student Satisfaction of online versus in-person BLAST course. We analyzed end of course survey data from 17 in-person BLAST courses (790 students) and 16 online BLAST courses (542 students). We performed nonparametric statistical testing with the Mann-Whitney U test due to data skewness. We found that the online course was equivalent to the in-person course in terms of survey items for end of course surveys. Students reported statistically higher satisfaction scores in 15 of the 17 areas surveyed (Table 3). Examples include course materials being clearly explained (M=5.74, SD 0.11, p<0.001), instructors encouraged student participation (M=5.79, SD 0.14, p=0.008), instructors providing opportunities to answer questions (M=5.87, SD 0.10, p=0.001), and instructors addressing students’ academic questions (M=5.82, SD 0.10, p=0.004).

The students also found higher satisfaction with the amount of instructor encouragement for student participation with the online course (M=5.79, SD 0.14, p=0.008) and that the instructors maintained a safe learning environment (M=5.86), SD 0.13, p=0.019). Students taking the online course also reported a statistically significant higher agreement with the phrase “I am confident that I can perform the tasks required by my career field based on what I learned” (M=5.52 online versus M=5.234, p=0.025) and “the course met my expectations” (M=5.58 online versus M = 5.28, p=0.006).

Students reported statistically lower satisfaction scores in equipment operating conditions (M=5.58, SD 0.14, p=0.037). There was no significant difference in satisfaction for the support of training aids between in-person and online versions (p=0.168).

Table 3. Summary of Mann Whitney U tests comparing in-person to online BLAST student evaluations

Survey Item	Mean (SD) In-person N=17	Mean (SD) Online N=16	P-value
Lesson objectives were clearly and thoroughly explained	5.46 (0.19)	5.68 (0.13)	0.001*
Hands-on exercises reinforced classroom instruction (performance tests, progress checks, laboratory exercises, simulations, cadavers, etc.)	5.40 (0.16)	5.61 (0.19)	0.006*
Training aids such as SMART Boards, mockups, videos, and visual aids supported classroom instruction.	5.51 (0.14)	5.58 (0.14)	0.168
Equipment was in good operating condition	5.53 (0.23)	5.43 (0.16)	0.037*
Student material on the Learning Management System platform, such as	5.47 (0.19)	5.64 (0.12)	0.015*

study guides, workbooks, and handouts, reinforced classroom instruction.			
The instructors clearly explained the course material.	5.49 (0.21)	5.74 (0.11)	<0.001*
The instructors were knowledgeable about the material taught.	5.64 (0.14)	5.82 (0.08)	<0.001*
The instructors encouraged student participation.	5.66 (0.14)	5.79 (0.14)	0.008*
The instructors provided opportunities to ask questions.	5.72 (0.17)	5.87 (0.10)	0.001*
The instructors addressed students' academic questions	5.68 (0.13)	5.82 (0.10)	0.004*
The instructors provided individual assistance when needed.	5.66 (0.09)	5.80 (0.12)	0.001*
The instructors maintained a safe learning environment.	5.78 (0.10)	5.86 (0.13)	0.019*
Test questions or other forms of assessment covered the material presented in the classroom, and/or discussed in study guides, handouts, or textbooks.	5.58 (0.14)	5.71 (0.14)	0.011*
Directions for progress checks were clear and concise.	5.42 (0.15)	5.66 (0.14)	<0.001*
Post test/progress check reviews were conducted.	5.50 (0.17)	5.64 (0.13)	0.008*
This course met my expectations.	5.28 (0.33)	5.57 (0.16)	0.006*
I am confident that I can perform the tasks required by my career field.	5.34 (0.25)	5.52 (0.12)	0.025*

*Significance set at $p < 0.05$

We also received positive feedback from students. Students wrote that “instructors were very detailed about going through examples and specific instructions on the objectives taught” and “Great videos and slides, great conversations, being an online course surpassed my expectations.”

Other students highlighted their experience with the online environment: “engaging and interactive”, “best virtual platform I’ve experienced”, “not a fan of DL but you guys did a great job. The interface was interactive and used pretty much every avenue possible for the best learning experience”, “as difficult as it is to get people engaged in a virtual environment, I

thought they did a great job getting people to speak up and helped facilitate some great conversation.”

Some students provided constructive feedback on the online environment: “I think that when we break off into our groups, a moderator should be included to help guide the group obtain the objective”, “virtual platforms made things a bit difficult from time to time”, “there's always going to be technical difficulty”, “it's unfortunate that VPN connections or government computers do not work well with the Blackboard forum.”

4.1.3 Student Satisfaction of online versus in-person BIC courses. We analyzed end of course survey data from 2 in-person BIC courses (24 students) and 5 online BIC courses (68 students). Due to the small sample size, we did not perform inferential statistical tests (see Table 4).

Table 4. Summary of Mann Whitney U tests comparing in-person to online BIC student evaluations

Survey Item	Mean (SD) In-person N=2	Mean (SD) Online N=5
Lesson objectives were clearly and thoroughly explained	5.61 (0.55)	5.71 (0.25)
Hands-on exercises reinforced classroom instruction (performance tests, progress checks, laboratory exercises, simulations, cadavers, etc.)	5.28 (0.86)	5.76 (0.14)
Training aids such as SMART Boards, mockups, videos, and visual aids supported classroom instruction.	5.56 (0.01)	5.74 (0.19)
Equipment was in good operating condition	5.48 (0.42)	5.25 (0.24)
Student material on the Learning Management System platform, such as study guides, workbooks, and handouts, reinforced classroom instruction.	5.42 (0.40)	5.68 (0.24)
The instructors clearly explained the course material.	5.46 (0.64)	5.80 (0.19)
The instructors were knowledgeable about the material taught.	5.58 (0.35)	5.92 (0.05)
The instructors encouraged student participation.	5.79 (0.17)	5.84 (0.13)
The instructors provided opportunities to ask questions.	5.78 (0.31)	5.94 (0.09)

The instructors addressed students' academic questions	5.68 (0.33)	5.96 (0.09)
The instructors provided individual assistance when needed.	5.68 (0.33)	5.93 (0.10)
The instructors maintained a safe learning environment.	5.75 (0.11)	5.96 (0.06)
Test questions or other forms of assessment covered the material presented in the classroom, and/or discussed in study guides, handouts, or textbooks.	5.63 (0.27)	5.76 (0.23)
Directions for progress checks were clear and concise.	5.41 (0.58)	5.75 (0.20)
Post test/progress check reviews were conducted.	5.78 (0.58)	5.83 (0.11)
This course met my expectations.	5.28 (0.31)	5.66 (0.21)
I am confident that I can perform the tasks required by my career field.	5.49 (0.22)	5.73 (0.08)

We also received positive comments from students. One student wrote, “Even though the course was virtual, the instructors were able to clearly outline the objectives and relate them to real world situations and examples. Great Job!” Another said, “The instructors did a masterful job in explaining the material in this challenging environment.”

We received constructive feedback as well. One student highlighted the challenge of multiple lectures in a day and wrote “I also think it would be beneficial on our long days to have multiple instructors teach the class rather than one that way we are not listening to the same person teach all day.” Another emphasized the importance of clarity while working in the online environment: “I know this is the first course virtually and we rolled with everything but there seemed to be confusions on times things were due and what exactly was due.”

4.1.4 Cost Analysis. The BLAST course hosts approximately 50 students, 15 times a year over five days. We estimated savings of approximately \$2,000 per student (travel, lodging, and meal costs) when students attend the course online versus face-to-face. This would be an estimated savings of \$100,000 per class and \$1.5 million per year for all courses (see Table 5).

Table 5. Cost Analysis

Course	Number of students	weekly cost	Total cost savings per class	Total annual cost savings
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BLAST	50	\$2000	\$100,000	\$1.5 million
BIC	10	\$2000	\$40,000	\$400,000

The BIC course hosts approximately 10 students, 10 times a year over 10 days. We estimated savings of approximately \$2,000 per student (travel, lodging, and meal costs) when students attend the course online versus travel for a face-to-face BIC course. Our ability to teach BIC saves approximately \$40,000 each class and \$400,000 annually.

The remaining costs for the course are constant and would be present for each course regardless of its delivery method. Both courses require a learning management system regardless of delivery online or in-person. However, the BIC course required an additional instructor in the online environment to serve as a back-up and manage the classroom chat box during synchronous class time for a total of two instructors online. If we consider the non-mandatory cost for a second instructor to be present during synchronous online class time, we could see an increase cost of approximately \$45 per hour for 64 hours per course (annual estimated cost of \$11,520 for 4 courses). However, we have not hired additional faculty nor seen an increase in our bottom-line costs to date.

The BLAST courses run with three instructors for the online and traditional face-to-face formats and have not required an additional back-up instructor.

4.1.5 Results from the Literature

The purpose of this literature review was to collect and synthesize current knowledge on best practices to convert face-to-face traditional courses to the online environment. Twenty-five studies met the inclusion criteria: six quantitative, seven qualitative, two mixed-methods, seven literature reviews, and three scoping/systematic reviews (see Appendix B). Overall, we identified 13 best practices to facilitate the transition. Five best practices were centered around course design: 1) course content needs to be intentionally designed; 2) the use of instructional design models should be considered in online courses; 3) asynchronous and synchronous tools should be used; 4) interactive media such as games, storytelling, case studies, blogs, and discussion boards are helpful; and 5) a strong plan to transition with a clear understanding of objectives and a plan to address each learning goal is needed. Three best practices emphasized the student and instructor interaction: 1) instructor and student engagement is critical; 2) students must be motivated to learn; and 3) faculty must provide timely feedback. Four best practices focused on the environment: 1) the environment must be safe and trustworthy for students; 2) expectations should be set; 3) flexibility is important; and 4) technical assistance must be available. Lastly, one best practice was centered around faculty development: 1) faculty training, mentorship, and coaching are needed for successful online courses.

Online learning is not a new concept. However, its demand has risen sharply since the onset of the COVID-19 pandemic. The phrase “online learning” has been used interchangeably with distance learning and e-learning. However, it is a unique field of its own. Online learning is like

the traditional classroom in a virtual environment with both student and instructor presence. Online learning is challenging, yet flexible and easily accessible (Regmi and Jones, 2020).

In a systematic review of 20 research studies, Co et al. (2021) found that student feedback was largely positive in the online environment. Students were more motivated and their performance improved online; however, they missed personal contact with instructors. Students also found issues with poor network connectivity and had more difficulty concentrating. Faculty reported that they liked the online platform for tracking students, monitoring performance, and updates. Yet, they found the online environment lacked hands-on experience for students and came with technical issues and high costs. Overall, online learning is a feasible alternative with consideration for the following best practices.

Course Design.

Online courses need to be intentionally designed. Poorly planned courses may not be successful. In a qualitative study with semi-structured interviews, Arinto (2013) described four areas of course design for online courses: content development, teaching strategies, learning activities, and learning assessment. The author emphasized the need to shift from pre-packaged content to materials and activities designed specifically for the online environment. The authors also emphasized the importance of fostering student engagement and participation, while providing timely feedback. The value of utilizing multiple teaching strategies was further emphasized by Breytenbach et al. (2017). Research supports a positive relationship between interactive strategies and knowledge outcomes.

Eom and Ashill (2018) applied a systems approach to successful online learning. The authors applied structural equation modeling to validate an online learning model at a university. Using data from 372 students, the authors found that student-student dialogue, student-instructor dialogue, and self-regulatory learning strategies played a mediating role between course design quality, instructor involvement, and student motivation and learning outcomes. Although motivation was not directly correlated to learning outcomes, it had an indirect effect on self-regulatory learning strategies that mediate the effect of motivation on learning outcomes. In addition, self-regulating behaviors may be indirectly enhanced by student-instructor dialog more than instructor activities.

Interactive activities and media such as active learning, games, storytelling, case studies, blogs, debates, learning groups, discussion boards, team projects, flipped classrooms, and scripted roles and scenarios engage students to participate and activate learning from different angles (Boyd et al., 2015; Camacho and Legare, 2020; Chilton et al., 2019; Hess and Greer, 2016; Karthik et al., 2019; Olesova et al., 2016; Pinchevsky-Font and Dunbar, 2015; Song and Park, 2021; Wasfy et al., 2021; Williams Sanga and Brogdon, 2021; Zygouris-Coe, 2012). Hess and Greer (2016) emphasized the value of learning communities to connect students beyond the classroom.

The use of real-world assignments is valuable to keep students connected. Chilton et al. (2019) report that active learning through a relevant project is an effective and unique method for teaching in the online environment. Applying knowledge from the course was important in improving student satisfaction and learning outcomes (Chilton et al., 2019). Well-designed courses promote active participation, well-designed collaboration learning, frequent feedback, and a personalized learning environment (Sowan and Jenkins, 2013).

Fitzgerald et al. (2021) recommend dividing content into small sections with synchronous and asynchronous content, using case-based or project-based learning activities, using adaptive learning, encouraging student interaction, and avoiding high levels of interactivity that do not result in higher knowledge gain. Flipped classrooms are also effective. This approach allows learners to gain foundational knowledge through asynchronous activities such as pre-reads and quizzes to prepare for face-to-face synchronous sessions (Fitzgerald et al., 2021).

Student and Instruction Interactions.

Creating a learning environment where the student is engaged contributes to positive learning outcomes (Pinchevsky-Font and Dunbar, 2015). An engaging online learning environment is challenging due to the natural degree that the online environment can appear isolating. Students are together in a virtual environment, yet alone in their physical environment. As such, maintaining motivation and interaction is key (Regmi and Jones, 2020). Educators must consider activities to maintain an active student-student and student-instructor interactions (Eom and Ashill, 2018; Song and Park, 2021).

The online environment can make it easy to give up if the student is not motivated to continue. Giving students the flexibility to work inside the online environment with or without other students and instructors is important for their self-motivation. Asynchronous and synchronous tools should be used (Camacho and Legare, 2016; Song and Park, 2021) to vary the degree of student engagement. Student centered learning approaches can be beneficial (Sowan and Jenkins, 2013; Wasfy et al., 2021). Engaging the students will minimize isolation and ensure all students progress through the course as needed. In addition, students must be motivated to manage their time and be responsible for their studies. Students will need a high sense of self-efficacy and confidence to give extra effort towards new tasks and persevere when confronted with obstacles.

Students become doers of learning rather than absorbers (Williams Sanga and Brogdon, 2021). Students appreciate leadership roles through facilitated protocols (Zydney et al., 2020). Students may benefit from the role of facilitator in discussions and instruction. As they are challenged with teaching material, they learn and as they learn, they can teach the material.

The Online Environment.

The online environment can be resource intensive—it raises information technology (IT) challenges and concerns for learners and faculty who are not familiar with online learning (Regmi and Jones, 2020). Technical assistance should be available to facilitate learning (Karthik et al., 2019). Easily accessible technical assistance reduces student and instructor frustration in the online environment and keeps the student engaged to learn. In a qualitative descriptive study with focus groups, Wasfy et al. (2021) found that experts emphasized the importance of adequate resources for online learning. The authors highlighted the need for user-friendly learning management systems, internet services, and a supportive IT team. Students benefit from clear expectations, tutorials on technology, and instructor feedback and support (Zygouris-Coe, 2012).

Faculty Development.

While redesigning online courses, Williams Sanga and Brogdon (2021) found that faculty members were committed to transforming courses but lacked time and training to follow through. Some of these faculty found it challenging to align course objectives and online

teaching strategies. Training is essential to successful online course conversions (Williams Sanga and Brogdon, 2021). Faculty need to be supported for the transition to online teaching.

In a study with 114 faculty members and 703 students, Daumiller et al. (2021) found that faculty goals and attitudes were important to the success of online teaching. Faculty with negative work and performance avoidance saw the shift to online as threatening, experienced higher rates of burnout, and received negative student ratings on teaching quality. The authors suggest faculty be reminded of the relevance and importance of viewing the online transition as a learning opportunity to improve their knowledge and competencies. They should also be reminded that mistakes are natural and helping resources exist (Daumiller et al., 2021).

4.1.6 Lessons Learned Report

Transitioning face-to-face courses to the online environment is challenging. The transition requires strategic use of technology, instructional design principles, increased student engagement, and a large time commitment on behalf of faculty, instructors, and staff. The following are lessons learned from our transition to online learning for two courses at USAFSAM.

Online courses need to be intentionally designed for the online environment.

The online environment is not a direct replication of traditional classrooms—it's different. The online space may be unfamiliar to students and instructors. It can be challenging to stay engaged and maneuver learning management systems. As such, online courses require careful planning to design courses that are specifically intended to function in the online environment. Online courses require course designers to consider how the student and instructor(s) will interact and meet the course goals in the online environment. They must consider multimedia options, lectures versus discussions, interactive training modules, and the importance of social presence.

Furthermore, instructor presence has a huge impact on the overall feel of the course. The social role of the instructor is extremely influential in the online environment and was found to be most crucial need for online teaching success. This social role includes purposeful student engagement, solid transitions, and real-time technology assistance. A well-designed course with the appropriate level of instructor interaction can make the student feel like it resembles an in-person course. It is important for instructors to engage with students as individuals and get to know them similar to a face-to-face course. Motivation is key in adult education. Designing and implementing a course that motivates the learner to engage in the material is the ultimate goal of instructional design.

Asynchronous online course time is not a set it and forget it option.

Regardless of whether as a small course component or the complete course delivery modality, asynchronous online course time is not a “set it and forget it” option. It requires instructor presence and student engagement with active learning activities. Instructors must plan and prepare asynchronous material to fit the class. They must also follow-up with students to ensure that the asynchronous work has been completed. We have found that discussion boards, journals, pre-reading material, and assignments keep students engaged in learning when they are not face-to-face with the instructor. We also recommend that at least one instructor be on “standby” to answer student questions or assist with technical difficulties during asynchronous activities.

Instructors need to be trained in online instruction.

Teaching or facilitating in an online environment is different than in traditional classrooms. We found that even our experienced instructors need specific and purposeful training to learn basic online instructional design principles, delivery methods, and best practices. The transition from face-to-face to online can require the acquisition of new technology as well as time, effort, and a period of adjustment for instructors and staff. Many instructors lack the expertise, technical knowledge, and instructional design skills to successfully pivot from face-to face to online learning.

With this knowledge, the USAFSAM Office of the Dean developed a course called Effective Online Instruction to prepare instructors for teaching online. This course provides instructors with a toolbox to maximize learning in the online environment. In this course, online teaching experts review best practices for online instruction, our learning management system, student engagement strategies, and synchronous and asynchronous tools. Although the data is not presented in this study, graduates of this course have provided positive feedback and shown their appreciation for this resource to prepare them for online instruction and transitioning courses to the online environment.

Instructor, student, and social presence are key to a successful online learning environment.

Online courses need to be designed to maximize student and instructor presence. We discovered that our online courses need to promote communication, interaction, collaboration, and active participation throughout the course. We encourage faculty to build student engagement into their lesson plans through direct, rhetorical, and overhead questions; quizzes; white board; small group breakout sessions and the chat box. Instructors must keep students engaged in the course during asynchronous time through discussion boards, active learning activities, quizzing, and collaboration rooms to meet with the instructors or other students to brainstorm. Course engagement should be intentionally designed and tailored to course objectives and course length.

4.2 Discussion

The team conducted a pre-post education intervention study in which we re-designed and transitioned two courses from face-to-face delivery to the online environment using evidence from the literature and the ADDIE model. We reported lessons learned on the transition of these courses, and we found that our students were highly satisfied with the online environment to include statistically significant differences in some of the line-item responses on the questionnaire.

Our findings emphasize the importance that one cannot ignore instructor and student engagement as part of lesson plan development. The online environment can be isolating. Instructors, curriculum developers, and instructional designers should develop plans of instruction that are tailored to engagement in the online environment (Eom and Ashill, 2018; Song and Park, 2021; Pinchevsky-Font and Dunbar, 2015; Regmi and Jones, 2020). Our students reported increased participation and opportunities to ask questions in the online environment than face-to-face due to our deliberate intention to include various interactive strategies and multi-media tools in lesson plans. Asynchronous time, which was utilized for both courses, allowed students to focus on learning before synchronous time, and this approach has been shown to be beneficial in

increasing student engagement in an online classroom (Camacho and Legare, 2021; Song and Park, 2021). Moreover, arranging online learning communities, such as digital small group rooms, facilitate student-to-student connections which can benefit students through discussion, assignment assistance, and other types of peer engagement (Hess and Greer, 2016).

Consistent with previous literature, our study found that working technology was foundational to student satisfaction and success in the online environment (Regmi and Jones, 2020; Karthik et al., 2019; Zygouris-Coe, 2012; Owston et al., 2013). We minimized technology issues by including a technology orientation in the course and having additional instructors available to troubleshoot problems (Wasfy, 2021; Karthik et al., 2019). Students must be able to connect to the classroom and material when taking courses online. As a government institution we are challenged by security systems such as Virtual Private Networks (VPNs). Firewall protections caused intermittent issues that were overall minimized but still noticeable by students. While technological issues may never be eliminated, it is essential to find a learning management system that works for the institution's unique environment (Wasfy, 2021). For example, we pivoted to students taking online courses from home versus on base, and instructed students to turn off their VPNs when possible for more successful connectivity.

While not all our courses can be transitioned to the online environment completely, we found opportunities for blended learning with most of our courses. Courses covering difficult topics or those with skills-based learning may be better suited for face-to-face environments. Courses designed for advanced learners or high achievers, on the other hand, could be better served in an online or blended environment (Owston, 2013). Using these lessons learned the USAFSAM Office of the Dean is working to transition other courses to a blended or completely online course environment. In summary, despite the upfront churn of course redesign, there are many benefits to online learning for students, instructors, and the organization to include cost savings, academic flexibility, and increased engagement through deliberate teaching strategies.

4.3 Limitations

The following limitations need to be considered in interpreting our findings. First, we did not have the raw data available to analysis difference between end of course survey scores for individual students. We analyzed mean satisfaction scores for each survey line item for each course. This limited our ability to conduct more detailed analyses for our BIC courses because we only had seven courses to analyze. However, we do not believe that our findings would change our findings overall. Secondly, we were unable to control for course modifications throughout the study and instructors across course iterations. Although the student satisfaction findings could be influenced by the quality of instructor, this is unlikely. All of instructors receive the same training and follow a basic plan of instruction to ensure all students receive the same basic information. Furthermore, the end of course surveys used were not tailored to delineate between course elements that were synchronous, asynchronous, or blended. Students may have different interpretations regarding questions about hands on activities, worksheets, and technology depending on course format. Indeed, some students provided qualitative comments regarding confusion for certain questions. Lastly, survey research has the inherent potential for participant and researcher bias. Participants may choose to respond to survey questions to please the faculty or may choose to not participate for a variety of reason.

Despite these limitations, our study had many strengths. We transitioned our courses to the online environment using a team-based approach to incorporating best practices from the literature. In addition, we sought the input from instructional designers, course directors, and subject matter experts.

5.0 CONCLUSION

USAFSAM's first rapid transition to online learning was successful. We identified best practices, successfully re-designed two courses, and reported cost savings and lessons learned. We found that student satisfaction increased overall from in-person classes to the online environment. Therefore, our next steps are to assist instructors in converting additional classes to a blended or online format. We plan to continue our Effective Online Instructor course to support instructors in learning more about online instruction and tools to make them successful.

5.1 Recommendations

Based on the analysis of the current study, we offer the following recommendations for future work. We learned that student satisfaction remained high in the two online courses analyzed, but future research is needed to learn more about the specific online teaching methodologies are most effective and ways to extend interactive media options. Researchers should consider qualitative designs to explore teaching methodologies and social interactions in the online environment. In addition, our course instructors benefited from the evidence-based Effective Online Instructor course to prepare them for teaching online. We recommend all instructors take the Effective Online Instructor course to familiarize themselves with multimedia tools and online teaching strategies to maximize student engagement. Future investigation should also include a thorough review of USAFSAM's existing end of course surveys, all of which were written for the in-person environment. Existing survey items such as "Hands-on exercises reinforced classroom instruction (performance tests, progress checks, laboratory exercises, simulations, cadavers, etc.)" and "Training aids such as SMART Boards, mockups, videos, and visual aids supported classroom instruction." are not directly translatable into the online environment. This could inadvertently provide misleading data to curriculum developers and course directors due to different student interpretations of statement. The use of a validated, standardized survey tailored to each environment is recommended. And, finally, future research should focus on modifiable student and instructor characteristics and behaviors that contribute to successful online learning. For example, what types of students and instructors benefit from online learning and what types of student and instructor behaviors can be modified or change to facilitate online learning. Future research could examine the role of autonomy, self-confidence, optimism, anxiety, and more.

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APPENDIX A – END OF COURSE SURVEY

	STRONGLY AGREE	AGREE	SLIGHTLY AGREE	SLIGHTLY DISAGREE	DISAGREE	STRONGLY DISAGREE
Lesson objectives were clearly and thoroughly explained.						
Hands-on exercises reinforced classroom instruction (performance tests, progress checks, laboratory exercises, simulations, cadavers, etc.).						
Training aids such as smart boards, mockups, videos, and visual aids supported classroom instruction.						
Equipment was in good operating condition.						
Student material on the learning management system platform, such as study guides, workbooks, and handouts, reinforced classroom instruction.						
The instructors clearly explained the course material.						
The instructors were knowledgeable about the material taught.						
The instructors encouraged student participation.						

	STRONGLY AGREE	AGREE	SLIGHTLY AGREE	SLIGHTLY DISAGREE	DISAGREE	STRONGLY DISAGREE
The instructors provided opportunities to ask questions.						
The instructors addressed students' academic questions.						
The instructors provided individual assistance when needed.						
The instructors maintained a safe learning environment.						
Test questions or other forms of assessment covered the material presented in the classroom, and/or discussed in study guides, handouts, or textbooks.						
Directions for progress checks were clear and concise.						
Post-test/progress check reviews were conducted.						
This course met my expectations.						
I am confident that I can perform the tasks required by my career field.						

APPENDIX B – LITERATURE REVIEW

Author (year)	Title	Purpose	Design	Sample/setting	Findings/implications
Arinto, P. B. (2013)	A Framework for Developing Competencies in Open and Distance Learning	To evaluate: 1) faculty's use of web technologies, 2) their perspective and approaches to online education, and 3) how their course design practices changed.	Qualitative descriptive study with semi-structured interviews.	8 full time faculty members and two affiliate faculty administrators at a university in the Philippines	Participants described four areas of course design for distance education: content development, teaching strategies, learning activities, and assessment of learning. They emphasized the need to shift from pre-packaged content to resource-based content and from materials to the design of learning environments and activities. The author reported that it is essential to foster learner engagement, participation, spontaneity, and immediacy. Faculty must provide timely feedback.
Boyd, M. R. et al. (2015)	Using Debates to Teach Evidence-Based Practice in Large Online Courses	To describe the authors' experience in using debates in large online undergraduate courses	Qualitative descriptive educational intervention	Large (greater than 200 students) online undergraduate nursing course in the southeastern United States	The authors found that debates help students engage with other students and practice critical thinking and leadership skills.
Breytenbach, C. et al. (2017)	An Integrative Literature Review of Evidence-Based	To determine the best evidence-based teaching strategies available that can be	Integrative literature Review	Research and non-research articles addressing evidence-based teaching	Reviewed 16 studies. Identified eight teaching strategies (e-learning, concept mapping,

	Teaching Strategies for Nurse Educators	used by nurse educators.		strategies of undergraduate nursing students in classroom settings	internet-based learning, gaming, problem-based learning, case studies, and evidence-based learning). Concept mapping, internet-based learning, and evidence-based interactive strategy showed positive effects on increasing knowledge outcomes. The use of multiple, integrative teaching strategies is supported.
Camacho, D. et al. (2021)	Pivoting to online learning—The future of learning and work	To identify best practices and opportunities for educators pivoting to online learning	Literature Review	Educators and Administrators / Transition to online and remote learning	Authors found that transitioning courses to the online environment requires a student-centered approach, clear understanding of objectives, and a plan to address learning goals. They recommend building communities online by encouraging student interactions and creating learning groups to avoid isolation. Collaboration and active engagement with learners is important. Asynchronous and synchronous tools should be used.
Chilton, J. et al. (2019)	A Process for Teaching Research Methods in a Virtual Environment	To increase understanding of research methods and translating evidence in	Quantitative descriptive education intervention	70 students enrolled in a translational science course	The authors taught a translational science course for online graduate nursing students using a project-

		nursing in a virtual environment			based concept. Overall student perception of the course was high. They found that the application of the teaching materials was important in their students' learning outcomes.
Co, M. et al. (2022)	Distance education for anatomy and surgical training - A systematic review	To evaluate the effectiveness of distance learning on anatomy and surgical training for medical students.	Systematic Literature Review	Included 20 studies on undergraduate and graduate medical students that met inclusion criteria.	Overall authors found that students provided positive feedback for distance learning, including e-learning for basic surgical skills (i.e. suturing). However, they missed the lack of personal contact with professor and poor network issues reduced student concentration. Faculty generally liked online learning for monitoring performance and updating fast changing knowledge but didn't like the lack of hands-on experience for students, technical issues, and high costs.
Daumiller, M. et al. (2021)	Shifting from face-to-face to online teaching during COVID-19: The role of university faculty achievement goals for attitudes towards this sudden change, and their relevance for burnout/engagement	To investigate the role of faculty members' achievement goals and attitudes towards the shift to online teaching during COVID-19 and their role in the student experience	Longitudinal study	114 faculty members; 703 student ratings of these faculty members	Many faculty members were in favor of the online shift. There was a strong correlation between performance approach and performance avoidance goals. Faculty with performance and work avoidance perceived the

	and student evaluations of teaching quality				change as threatening, which was related to burnout and negative student ratings of teaching quality. The findings suggest that faculty goals and attitudes are important in the success of online teaching. The authors recommend that faculty be reminded of the relevance and importance of seeing the online transition as a learning opportunity to improve their knowledge and competencies. They should also be reminded that mistakes are natural and resources exist to help.
Eom, S.B. and Ashill, N.J. (2018)	A System's View of E-learning Success model	To apply structural equation modeling to empirically validate a comprehensive model of e-learning success in university setting.	Cross-sectional survey	Midwestern university in the United States	Findings indicate that the e-learning success model satisfactorily explains and predicts the interdependency of six critical success factors of learning systems (course design quality, instructor, motivation, student-student dialog, student-instructor dialog, and self-regulated learning) and perceived learning outcomes.
Fitzgerald, D. A. et al. (2021)	Blended and e-learning in pediatric education:	To describe best practices for the	Literature review		There are several teaching strategies that

	Harnessing lessons learned from the COVID-19 pandemic	conversion to online learning platforms.			provide a basis for online and blended learning environments. Flipped classroom approaches allow learners to gain foundational knowledge to prepare for face-to-face synchronous sessions. This allows students to build their knowledge through other activities and discussions later. The authors recommend dividing content into small sections with synchronous and asynchronous content, using case-based or project-based learning activities, using adaptive learning, encouraging student interaction, and avoiding high levels of interactivity that do not result in higher knowledge gain.
Hess, A.N. and Greer, K. (2016)	Designing for engagement: using the ADDIE model to integrate high-impact practices into an online information literacy course	To describe how a team of librarians used the ADDIE instructional design model to incorporate best practices in teaching and learning into an online, four credit information literacy course.	Literature review and redesign of course		The authors applied the ADDIE model to redesign an online information literacy course. They reviewed course content, instructional methods, and student engagement. They integrated current e-learning practices using

					the ADDIE model and found that other librarians may also find other applications for the model in their own teaching practices.
Hollowell, G. et al. (2017)	Course Design, Quality Matters Training, and Student Outcomes	To assess online science courses and instruction.	Pre/Post intervention Cohort Design	North Carolina Central University faculty and students in an online Introductory Biology class.	Faculty completed online training course called Quality Matters and found that they were able to implement the changes in their online courses. Post training student exam scores, student course averages, and quality matters informal review scores improved. The authors suggest that a Quality Matters training course could be utilized as an effective strategy to increase quality of online science, technology, engineering, and mathematics courses.
Jusas, V. et al. (2021)	Models for Administration to Ensure the Successful Transition to Distance Learning during the Pandemic	To develop models for distance learning	Survey	10 experts from higher education with at least five years experience	The authors scored the experts' critique of five models: a conceptual model of distance learning, a model of strategic planning of distance learning, a model of assessment before the start of distance learning, a model of the preparation for distance learning, and a model of

					the process of distance learning and remote work. They determined that the models were suitable to use for the transition to distance learning.
Karthik, B. et al. (2019)	Identification of Instructional Design Strategies for an Effective E-Learning Experience	To identify effective instructional design strategies from different E-learning perspectives.	Qualitative descriptive with semi-structured interviews	Instructional designers, business school students, and corporate employees involved in e-learning	Thematic analysis revealed six themes: technical assistance, problem-based learning, aesthetics, gaming, storytelling, and social support. The authors found that design strategies may vary and designers must be clear on their objectives and goals for the course. Instructor feedback is essential for effective performance in an e-learning environment. Instructional design strategies that incorporate aesthetics, problem-based learning, technical assistance, gaming, story-telling and social support are highly effective to facilitate learning.
Lyons, T. (2013)	Omnipresent Learning via Interactive Media	To examine the effectiveness of instructor facilitated discussion board activities and digital storytelling in an online nursing research course	Mixed methods	60 faculty and 1400 nursing students at large research university in the northeastern United States	The authors found that discussion boards and digital storytelling increased student satisfaction and reflective thinking.

McClary, J. (2013)	Factors in High Quality Distance Learning Courses	To identify design principles of DL courses	Literature review		Article discusses eight principles of course design centered around Elias (2010). Course content, course instructor, support systems, and overcoming major barriers to quality distance learning courses were also discussed.
Olesova, L., et al. (2016)	Exploring the effect of scripted roles on cognitive presence in asynchronous online discussions	To identify the effect of scripted roles in asynchronous online discussions	Quantitative content analysis	139 undergraduate students at university in mid-Atlantic region of the United States	The authors assigned students to a specific task: starter, skeptic, or wrapper. Students then interacted in the discussion according to their role. The authors found that scripted roles can be an effective learning strategy.
Pinchevsky-Font, T. and Dunbar, S. (2015)	Best practices for online teaching and learning in health care related programs	To explore evidence related to online teaching and learning	Literature review		Best practices address instructor presence, cognitive presence, and teaching presence. Instructors should use an online teaching/learning model. Using social tools, engaging the students, and creating a learning environment where the student is real (not an avatar) contribute to positive learning outcomes. It may be helpful to promote autonomous thinking, critical

					reflection, and self-direction.
Regmi, K. and Jones, L. (2020)	A systematic review of the factors – enablers and barriers – affecting e-learning in health sciences education	To identify and synthesize enablers and barrier to e-learning in health sciences education	Systematic review		Reviewed 57 articles and found eight themes: e learning; learning in practice; systematic approach to learning; integration of e-learning into curriculum; poor motivation and expectation; resource-intensive; not suitable for all disciplines or contents, and lack of IT skills. The authors found that E-learning is flexible and easily accessible. It enhances learning and performance. However, integrating e-learning into curriculum is challenging. Need to focus on the interaction between students/facilitators, self-assessment, flexibility, and access to quality learning resources.
Scott, K.M. et al (2017)	Evidence-based principles for using technology enhanced learning in the continuing professional development of health professionals	To propose ten principles on the use of technology to enhance learning in health professionals.	Literature Review	Written for health professionals	Ten principles: 1) clarify purpose and conduct a needs assessment; 2) ensure there is sufficient time for technology and program development; 3) use proven approaches to improve

					learning; 4) consider the need for a skills component; 5) enable interaction and discussions between learners and others; 6) tailor resources for different groups; 7) pilot program changes before implementing; 8) incorporate measures to motivate and retain learners; 9) provide opportunities for spaced education and revision to aid retention; and 10) evaluate learning outcomes
Song, C.E. and Park, H. (2021)	Active Learning in E-Learning Programs for Evidence-Based Nursing in Academic Settings: A Scoping Review	To identify how to implement active e-learning for evidence-based practice in academic settings	Scoping Review	17 studies on e-learning	The study summarized evidence from 17 studies and identified activities such as discussions, asynchronous communities, student-student interaction, and student-teacher interactions as primary activities for active e-learning. The authors recommend that educators plan, apply, and evaluate appropriate activities for the online environment.
Sowan, A.K. and Jenkins, L.S.(2013)	Designing, delivering, and evaluating a distance learning	To describe the design and delivery of an online course and examine outcomes of	Mixed methods	32 students enrolled in a distance class; 28 students enrolled in	Authors found that students were highly satisfied with the online course and achieved better than students in

	nursing course responsive to students needs	online versus a hybrid course.			the hybrid course. All online learning students successfully completed the course. Major concerns were related to the lack of time management skills and attitudes towards group assignments. The authors emphasized the importance of continuous support, prompt feedback, and continuous interaction with between the student and instructor. Students in the online environment found satisfaction in having an active role in the learning process and engaging in discussion boards. Well designed courses promote active participation, well-designed collaboration learning, frequent feedback, and a personalized learning environment.
Wasfy, N. F., et al. (2021)	A guide for evaluation of online learning in medical education: a qualitative reflective analysis	To develop a set of descriptors for best practice in online learning in medical education	Qualitative descriptive	30 international faculty members split into five focus groups	Authors developed a set of standards for best practices in online learning including organizational capacity, educational effectiveness, and human resources. Experts discussed importance of a user-

					friendly learning management system (LMS), internet services, and a supportive IT team. Student engagement and engaging environment was challenging for many participants. Teaching and learning materials should be adapted for the online environment. Multimedia such as gaming, quizzes, and multi-media principles need to be considered.
Williams Sanga, M. and Brogdon, S.L (2021)	Designing for Distance Learning: Analyzing the Process of Redesigning Online Courses Using the Three Pillars Method	To analyze the process through which 37 online courses were redesigned over three years using the Three Pillars Course Transformation Method.	Six step method to analyze and redesign courses (Three Pillars Method)	37 online courses	Thirty-seven courses were redesigned with modern teaching strategies and active learning strategies. Course developers had instructional design support. The authors highlight that an informative syllabus, comprehensive module development, measurable learning objectives, and high levels of active learning were aspects of successfully improved online courses.
Zydney, J., et al. (2020)	Learning through experience: Using design-based research to redesign protocols for	To design a blended synchronous learning environment in a graduate education course	Qualitative exploratory study which used design-based research.	Midwestern university in the United States	The authors designed a course through three iterations to examine the influence of protocols on the

	blended synchronous learning environment				experiences of students and instructors in a blended synchronous environment. Students appreciated leadership roles through facilitated protocols. Deep connections were unachievable due to multi-tasking required in blended environment. Trust was hindered by the unpredictability of the online environment. Students were hyperaware of time due to the unpredictability of the environment. Authors recommend minimizing distractions, technology issues, and overwhelming students. Instructors must set expectations up front.
Zygouris-Coe, V. (2012)	Collaborative learning in an online teacher education course: Lessons learned	To present design element guidelines for online education.	Literature review	Large metropolitan university in central Florida	The authors write that designing courses with a focus on collaborative learning takes time, planning, attention, trust, reflection, monitoring, and community building. Students will benefit from clear expectations, tutorials on technology, and instructor feedback and support.

LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

ACRONYM	DESCRIPTION
ADDIE	Analysis, Design, Develop, Implement, Evaluate
AOME	Aerospace and Operational Medicine Enterprise
BIC	Basic Instructor Course
BLAST	Basic Leadership Airman Skills Training
COVID-19	Coronavirus Disease 2019
CTS	Course Training Standard
DL	Distance Learning
IRB	Institutional Review Board
IT	Information Technology
LMS	Learning Management System
POI	Plan of Instruction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SKA	Skills, Knowledge, and Attitudes
USAFSAM	United States Air Force School of Aerospace Medicine
VPM	Virtual Private Network