The Impact of Agile Elements on ADDIE: The Agile ADDIE Framework

by

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ABSTRACT

The traditional analysis, design, develop, implement, and evaluate (ADDIE) model is inadequate for dealing with the instructional design requirements of today's constantly evolving world. This reality is especially true at the National Simulation Center where medicine and technology are constantly changing. To provide the best care for the nation's veterans, the educational products must too reflect the current state of medicine.

The Agile ADDIE Framework was developed to overcome challenges such as a constantly changing domain, external threats to the development process, and the need for expedited timelines while still creating quality products. Using agile theory, including the agile manifesto, as a theoretical framework, the Agile ADDIE Framework was created. The Agile ADDIE Framework implements agile elements into the traditional ADDIE model, such as an iterate, assess, and align (IAA) cycle in an effort to increases in flexibility, quality, and efficiency.

A mixed method action research project reviewed the impact that agile elements had on the ADDIE model at the National Simulation Center. The working group participants underwent biweekly meetings using scrum methodology. Data collection included pre- and post-intervention interviews, weekly structured reflections, focus groups that occurred throughout the development process, and a burndown log to track performance. Additionally, the course that was created using the Agile ADDIE Framework was compared to a product that was completed using the traditional ADDIE model by a panel of instructional designers.

Participants identified that the Agile ADDIE Framework was able to create a higher-quality product in a shorter amount of time when compared to a training support package developed using the traditional ADDIE model. Several themes emerged from the data, including the Agile ADDIE Framework was perceived to be more flexible and engaging to subject matter experts. There was also a discussion involving lesson learned, limitations, and implications for both practice and the domains. Future research considerations include the implementation of the Agile ADDIE Framework in a more generalized study. This study presents a framework that enables traditional ADDIE model instructional design operations into an agile era.

DEDICATION

For my son, Ryan: Thank you for your sacrifice, love, and understanding throughout the dissertation process. I love you!

For my parents, Lars and Mary Beth: I will always appreciate all that you have done. Your support has been constant and unwavering. You continue to set the standard on how to be great parents.

Cynthia: I'm still wondering how I got so lucky! Your encouragement and love are a constant source of strength.

For my family, friends, and loved ones: I could not have done this without you, you are my source of strength. Thank you for being there for me throughout my doctoral program.

For the Heroes of the 1-30th INF Bn, 3rd ID - Arab Jabour, Iraq (2007-2008). You will never be forgotten. Your sacrifice is my daily reminder to live the best possible life.

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INTRODUCTION

The use of the instructional design model analysis, design, develop, implement, evaluate (ADDIE) has become one of the most well-known processes for creating instructional materials, and is synonymous with instructional design (Bichelmeyer, 2005). Although the ADDIE model has become a bedrock for instructional designers, there are variations on the way it has been implemented throughout the industry. Furthermore, the instructional design community has not only implemented the ADDIE model in various ways, but the community has also become increasingly critical of its use (Bichelmeyer, 2005). The ADDIE model has become ineffective and inefficient (Allen & Sites, 2012; Tripp & Bichelmeyer, 1990). A criticism specific to the government context where ADDIE model is employed is government institutions make the ADDIE model increasingly difficult to implement with levels of nonessential tasks that prevent progression and stall progress (Gordon & Zemke, 2000).

In 2011, the U.S. Army published Training and Doctrine Command (TRADOC) Regulation 350-70 with the purpose of consolidating all guidance for creating instructional material. TRADOC Regulation 350-70 outlined the implementation of the ADDIE model for the U.S. Army. Specifically, the regulation detailed how the United States Army intended to employ the concepts and processes from a framework perspective. The United States Army authorized the use of a nonlinear version of ADDIE upon identifying that the implementation of the ADDIE model would not fit all the instructional design requirements for development. The U.S. Army stated, “New product

development may require a more linear process, whereas product revision may be much less linear." (Training and Doctrine Command, 2011). The 124-page TRADOC Regulation goes into detail on how committees must be formed to develop a single course, the software system which each course will use to create documentation, and the limitations in which the systems will operate. To implement TRADOC Regulation 350-70 completely, local commands must provide additional guidance, thereby making the regulation more complex and varied across the enterprise.

The United States Army adjusted the implementation of the ADDIE process by making it less linear. Similarly, the United States Navy implemented Navy Educational Training (NAVEDTRA) Regulation 130B in 2009, which adjusted the traditional ADDIE model by adding a planning phase, resulting in their own PADDIE model. The P in the PADDIE model, "identifies resource requirements and the sequence of events in the development process." (Naval Education and Training Command, 2009). By adding the planning phase into the ADDIE process the United States Navy further extended an instructional design model created to make instructional design effective and efficient.

The ineffective nature of the current implementation of the ADDIE model slows progression of instructional design products, leaving requirements from the implementing entity unfulfilled (Gordon & Zemke, 2000). When referring to the ADDIE process Bichelmeyer (2000) remarked, "These criticisms say that the primary model of instructional design in the field of IDT does not guarantee quality, does not work efficiently, is out of date, and doesn't even reflect the real work of instructional design"

(p. 4). There is serious concern about the ability for the ADDIE model to create products that meet quality expectations of implementing entities (Allen & Sites, 2012).

Both Allen (2012) and Tripp and Bichelmeyer (1990) identified that the development of instructional products typically requires an iterative approach, and that the ADDIE model does not incorporate any iterative design structure. The linear structure of the ADDIE model, and even the nonlinear augmentations of the ADDIE model, do not promote an iterative cycle. Therefore, even the adjusted ADDIE model cycles that currently exist do not overcome the obstacles of producing materials that are inefficient. In reaction to the poor performance of the ADDIE model, instructional designers have experimented with alternative processes. One effective technique involves incorporating agile principles into new models (Tripp & Bichelmeyer, 1990). Agile learning models provide instructional designers with alternative methods of instructional design processes to overcome the pitfalls of the ADDIE model, and inform the Agile ADDIE Framework.

The rapid prototyping model (RPM) focuses on providing an iterative design philosophy (Tripp & Bichelmeyer, 1990). RPM is focused on being quick to implement, as well as quick to iterate, based on feedback from the initial prototype changes. Another agile learning model is the successive approximation model (SAM). SAM also takes a flexible approach to instructional design although it approaches the overall instructional design methodology differently (Allen & Sites, 2012). Both SAM and RPM played fundamental roles in shaping the Agile ADDIE Framework.

To date, the ADDIE model is the most commonly implemented instructional design models and processes (Allen & Sites, 2012). Although many organizations have

employed the ADDIE model, they still suffer from ineffective and inefficient instructional products being produced (Gordon & Zemke, 2000).

Situated Context

The Veterans Health Administration (VHA) created the National Simulation Learning, Education and Research Network (SimLEARN) in 2009 with the goal of improving healthcare for veterans using simulated learning strategies (*About Us - VHA SimLEARN*, n.d.). In 2016, the VHA opened the National Simulation Center, which is part of SimLEARN, to create training using simulated environments for the employees across the entire VHA (Miller, 2016). Courses are mainly offered in two modalities, train the provider (TTP) and train the trainer (TTT). Learners travel to the educational institution, such as the National Simulation Center, when using a TTP modality. In contrast, facilities will send trainers to be taught how to implement a Program of Instruction with the TTT modality, and those trainers will later serve as the instructors at their facility. Courses using the TTT modality require additional materials within the training support package to ensure continuity of the curriculum, which extends the development timeline.

Due to the heavy emphasis on simulation, courseware typically includes products such as anatomically correct simulated organs to allow the learner to conduct hands on training. Obtaining, managing, and caring for the products are part of the lifecycle of course management at the National Simulation Center. The emphasis on acquisition and distribution adds time to course development, although it is necessary for the proper implementation of a course lifecycle.

Prior to January 2017, the National Simulation Center had developed approximately 10 two- to four-day courses, with a development time for each of approximately 12 to 15 months. The long course development time caused questions on how to efficiently meet deadlines as the demand for new courses grew. As of January 2017, 41 new courses had been requested. To meet the new demand, a 100-day (5-months) development plan following the ADDIE model was announced and put into place to better meet the required course load. Unfortunately, the 100-day ADDIE model did not change the process, but rather just shorten timelines within each phase of the ADDIE model. Without regard to complexity of the domain, complexity of the program, resources, available staff, or modality of the program the 100-day development plan was unable to maintain the aggressive timeline, and programs slipped back to a 12 to 15-month course development cycle.

Before the Agile ADDIE Framework had been implemented, the National Simulation Center used the traditional ADDIE instructional design model with some slight modifications. The pre-intervention ADDIE model incorporated an acquisition and distribution process for materials required to teach each course as a prerequisite to moving forward with the analysis, which extended the development cycles.

Analysis

Upon receiving a request for a training product, a needs assessment was constructed to identify or validate the existence of a performance gap or problem that can be solved by training (Clark, 2015a)**.** During the pre-intervention ADDIE model, course requests were often initiated through ad-hoc channels with ill-defined purposes and

audiences, although learning consultants worked with the requesting parties to refine initial requirements. The pre-intervention ADDIE model also relied on the need assessments being completed for each project by a learning consultant, with the instructional designer not participating until its completion. Resource constraints, specifically overtasked learning consultants, meant instructional designers would either complete the needs assessment for their programs, or forgo the needs assessment entirely with the program lacking a true needs assessment. Either reactionary measure increased the development time.

After the need assessment is completed, a Front-End Analysis is created to confirm the training gap in the need assessment, reviews tasks associated with the identified training gap, and identifies the goal of the training being created (Clark, 2015a)**.** A Front-End Analysis was required to be completed before reaching the design phase of the pre-intervention ADDIE model, although a Front-End Analysis was rarely conducted. Instructional designers often moved directly into the design phase of the pre-intervention ADDIE model without conducting any true analysis besides an ad-hoc meeting with stakeholders due to the lack of assessment that was conducted and the requirement for progression into the design phase.

A Front-End Analysis is an important part of the development process. All courses that the National Simulation Center produce typically deal with medical subject matter, which contain domain specific problems (Clark, 2015a)**.** Due to the time constraints of the learner, who typically provide vital services to veterans and have full time workloads, courses developed at National Simulation Center are limited in their

length. The short timeframe for courses can cause issues with cognitive overloading. Therefore, the learner analysis, target audience, and purpose of the course are all extremely important to properly assess for both pre-existing knowledge of the learner as well as the expected instructional gap that the training program will address.

Design

Within the National Simulation Center, the design phase of the pre-intervention ADDIE model is where the instructional designers become engaged in the development process. Because the needs assessment was not typically being completed, the instructional designer usually must go back and complete it retroactively, causing further delays in the timeline. After the analysis phase is completed, the design phase begins. The design phase requires instructional designers to have access to subject matter experts (SMEs) to validate highly technical medical procedures. During the design phase, the learning objective, task analysis, agenda, course flow, and evaluation strategy are created.

Development

Development, specially the development of instructional materials, is another phase of the ADDIE model that requires an intensive amount of SME time. During development, instructional designers will create instructional materials, and work with SME to ensure content is correct based on their domain knowledge. Typically, SMEs are not assigned solely to the National Simulation Center as they divide their time between developing instructional material and treating patients in VHA facilities. With the use of simulations, scenarios are also created that focus on the use of simulating medical procedures. Although an SME will work with the instructional design during the design

phase to identify specific procedures and situations to assess learning, the creation of actual scenarios within a cooperative effort with the simulation technologists (SimTECHs). The SimTECHs help develop the technical aspects of the scenario with the instructional designer and SME to create a simulation that best demonstrates the skills to show proficiency according to the learning objectives.

Implementation

The implementation phase begins when the course is piloted and after the major construction of course material has been completed. The instructional designers hand off the product to a sustainment Program Manager and the Program Manager provides oversight of the course throughout the remaining lifecycle of the instructional product. The implementation and evaluation phases are outside of the 100-day (5-month) development cycle and courses are reviewed for changes once a quarter based on feedback. Courses are also reviewed for methodological changes by SME once a year during the annual review of the course.

Evaluation

Although summative and persistent evaluation strategies are critical to evaluating the training, the National Simulation Center often did not implement evaluations besides Kirkpatrick Level 1 evaluations prior to February 2017. Kirkpatrick Level 1 evaluations only measure the immediate reaction the learner has to the training, and not the actual learning outcomes that were achieved (Kirkpatrick & Kirkpatrick, 2016; Phillips, 1996). The other levels of evaluation Kirkpatrick, which provide essential pieces of the evaluation of training, such as establishing that learning took place (Level 2) and that

learning transferred to the job (Level 3), did not take place pre-intervention (Phillips, 1996).

Adjustments

Although a critical part of the design phase, prior to January 2017, there were no summative evaluation strategies implemented at the National Simulation Center due to a fear that the assessment may impact job evaluations. The lack of summative evaluations means that no students going through the National Simulation Center have ever been evaluated on reaching the learning objectives of particular courses. In February 2017, another instructional designer, several Program Managers, and I convinced the National Simulation Center Administration that an assessment of the learners understanding of content was critical.

In February 2017, I also initiated the templating of several instructional design forms to streamline SME involvement within the analysis and design phases of the ADDIE instructional design model. The created templates increased continuity between different courses, as prior to the templates no two courses had similar documentation, nor did they have definitive documentation with learning objectives and outcomes. I discovered this significant issue when having to take over a course from another instructional designer where I was unable to identify any basic instructional documentation. Although the templating initiative increased continuity between instructional designers and streamlined SME involvement, it only slightly adjusted the processes already in place.

During the templating initiatives, I also created a common lesson plan template, PowerPoint template, and overarching file structure for all instructional materials that had not previously existed. The templates enabled the instructional designer to setup the templates to support the instructional design while also allowing the SME to fill in content. Again, while the templating initiative increased continuity between instructional designers and streamlined SME involvement, it only slightly adjusted the ADDIE processes as implemented by the National Simulation Center.

In July 2019, I initiated a revision of the training support package structure and format. The National Simulation Center was able to arrange for the curriculum developers to gain access to the Adobe Creative Cloud suit, providing access to additional tools. The adjustment of the file formats also led to easier navigation by the instructors, educational technicians, and Program Managers. The additional of a singular program file that wrapped up the entire training support package, and its requirements, also enabled instructors to better prepare for their classes by seeing a wholistic view of the course.

The ADDIE model, as implemented by the National Simulation Center, is based on a linear process without consideration for how development progress may be impaired by resource limitations, changes in the domain, or adjustments in scope and time. If the analysis is done incorrectly or changes to the courses scope are adjusted, the current model does not support rapid adjustments. With medical advances quickening, the ability to react to changes in the domain are increasingly important. Due to the dynamic nature of medical domain, the ADDIE model must be efficient and flexible to react to the

changing environment within the medical field, and the ever-changing requirements of the organizations that SimLEARN hopes to support with the training.

Purpose Statement

Based on the identified issues with the ADDIE model from instructional designers and organizations at the national level, and issues identified at National Simulation Center, improvements to the ADDIE model must be explored. Allen (2012) has argued that a new process or model should take the place of ADDIE. Although the ADDIE process does have systemic issues, its widespread adoption with significant resources devoted to its implementation makes full-scale replacement unlikely, or at the least very costly. Rather, other options outside of the ADDIE model that offer new techniques and procedures should be reviewed for the strengths they provide to their respective model. These strengths could present significant benefits to the ADDIE model while not changing the underlying concepts. The implementation of the ADDIE model by the National Simulation Center provides an opportunity to explore the impact of taking the best practices of agile learning models, to include SAM and RPM, and apply them to the ADDIE process.

The purposes of this study were to:

(a) explore which agile elements could be applied to the ADDIE instructional design model to increase efficiency and effectiveness,

(b) identify the impact of employing a modified ADDIE model that was influenced by agile learning models, and

(c) identify what impact on quality an agile influenced ADDIE model had on produced instructional products.

Being able to explore these questions within the study will have far reaching consequences for not just the National Simulation Center, but could impact instructional design models in a more general sense.

Research Questions

This study will focus on the following research questions:

RQ 1: How did using the Agile ADDIE Framework in development working groups in nontraditional learning environments help overcome the perceived issues of:

- Lengthy development time
- Inflexibility during development
- Resource constraints during development

RQ 2: How, and to what extent, did implementing the Agile ADDIE Framework affect the quality of developed materials in nontraditional learning environments?

CHAPTER 2

THEORETICAL PERSPECTIVES AND RESEARCH GUIDING THE PROJECT

The previous chapter identified that the ADDIE model has significant issues with its implementation at the national level, and at the VHA's National Simulation Center. This chapter will explore the theoretical perspectives of alternative instructional design models through a review of existing literature which directly informs the intervention of the action research. The first section is focused on rapid prototyping, and the second section is focused on SAM, both agile learning models. Each section will present a review of the theoretical model, and then review the literature associated with that perspective.

Agile Learning Models

Agile learning models provide an adaptive framework in which instructional design projects can be developed. Originally developed as a software development solution within the information technology industry, agile development methodology has been adopted to address instructional design issues in the educational technology and instructional design field (Tiger & Hess, 2012). Although there are many agile instructional design models, typically these models are iterative, flexible, and reactive to the design and development environment (Clark, 2015b). Although the ADDIE instructional design model has a string of interdependent processes, agile learning models operate to be adaptive to the development process and to the events that occur within the development process (Clark, 2015b). Two prominent agile learning models are rapid prototyping and SAM. It should be noted that while there are several books on different

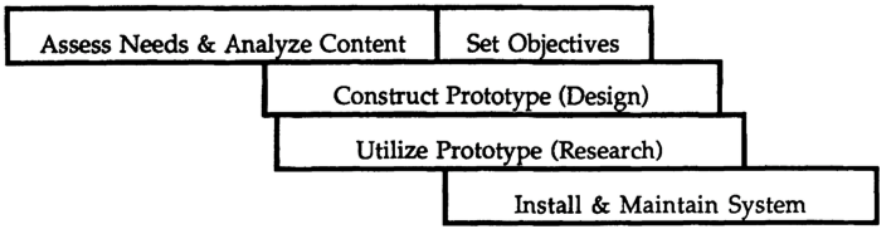
agile learning models, to include the SAM, very few studies focus on the impact of implementing an agile instructional method like SAM.

Rapid Prototyping

Rapid Prototyping provides a unique framework and model for the creation of instructional products. Although originally a software development framework, rapid prototyping has been adapted as an instructional design model, as seen in Figure 1 (Tripp & Bichelmeyer, 1990). Significant adaptation to the RPM was not required when making the transition from software to instruction, as the environments are similar (Tripp & Bichelmeyer, 1990).

Figure 1

Rapid Prototyping Model (Tripp & Bichelmeyer, 1990)



The ADDIE instructional design model is sequential in its approach to creating a step-by-step blueprint for instructional design (Allen & Sites, 2012). In contrast to the ADDIE instructional design model, rapid prototyping is fluid and agile in its approach to design (Nixon & Lee, 2001). A great example of this agility is the analysis phase of the ADDIE process. Although an analysis in the ADDIE instructional model is singularly focused on completing that section of the process, rapid prototyping conducts parallel development during the analysis phase (Tripp & Bichelmeyer, 1990). Parallel

development enables the instructional designer to conduct the analysis while also looking at the design, allowing for the process to inform, and be informed by the work occurring in other sections of the development of the product.

Like most instructional design models, rapid prototyping begins with an analysis of the needs and content of the instructional design project. As seen in Figure 1, while assessing the needs of the project, the creation of prototypes is started (Tripp & Bichelmeyer, 1990). This is a departure from the ADDIE model, as parallel development does not occur within traditional ADDIE implementations. The ability to create a prototype without identifying learning objectives occurs through the assumption that the learning objectives will be informed by the analysis, therefore there is enough information to start creating prototypes (Tripp & Bichelmeyer, 1990). Prototypes within instructional design focus on providing a representation of a product to derive feedback from the user or client (Daugherty et al., 2007). It should also be noted that creating prototypes may also inform the learning objectives based on outcomes of the prototypes.

Another aspect of using the RPM in the development of instructional projects is the collection and analysis of feedback from the end user (Tripp & Bichelmeyer, 1990). The construction of prototypes must be done in conjunction with feedback from learners. Learner interaction with prototypes provide the instructional designer an understanding of what needs to be improved to make the prototype more effective or efficient. For example, having a group of potential learners test an early mockup of an eLearning product will give valuable feedback early in the design process. It should be noted that the process of prototype development during rapid prototyping is an iterative process

(Nixon & Lee, 2001). Instructional staff may also be used for researching a prototype's effectiveness (Desrosier, 2011). The final step of the process is the implementation and evaluation of the system within the implementation setting.

When creating a product, the variables within the analysis phase are often not fully discovered, and the instructional designers do not have enough information to create a design that accounts for all the circumstances (Tripp & Bichelmeyer, 1990). An example of evolving variables occurs when tasks for the performance of the gap are adjusted, new policy is created, or a learner population emerges that was not previously assessed. Rapid Prototyping attempts to create prototypes early within the instructional design process while analysis is still ongoing. By employing parallel development techniques, rapid prototyping can develop an instructional product that will inform the analysis, and become iteratively better (Tripp & Bichelmeyer, 1990). Parallel development also enables the prototype development process to create prototypes that evaluate alternative course of action, which can be analyzed for its viability during the analysis phase (Tripp & Bichelmeyer, 1990). Demonstrating different courses of action to the client through the use of low fidelity prototypes provides the client with a better understanding of the end-state, and further involves the client or stakeholder in the development process.

Studies of rapid prototyping. The use of parallel development and the implementation of prototyping within the develop cycle is fundamental to the construction of the Agile ADDIE Framework. The concept of creating a product that is iterative in nature feeds directly in the process. Rapid prototyping concepts specifically contribute to the Agile ADDIE Framework to increase the efficiency and adaptability of the development effort. Through the use of key rapid prototyping elements, specifically prototyping, quality of the overall product is also improved.

Efficiency. The RPM has been shown to reduce the overall timeline for instructional design projects when compared to projects created by traditional instructional design models (Adnan & Ritzhaupt, 2018; Jones & Richey, 2000) . One key contribution to reducing timelines comes from the reduction of the time spent in the analysis phase (Desrosier, 2011). Desrosier (2011) identified a significant departure from the ADDIE model was the removal of a lengthy analysis phase, replaced by a much briefer analysis.

To further reduce the development cycle timelines, rapid prototyping allows for opportunity to show stakeholders prototypes during the development cycle (Jones & Richey, 2000). The opportunity to have stakeholders review prototypes reduces the likelihood that stakeholders will object to products further in the development or implementation cycle. Other than stakeholders, Derosier (2011) also showed the value of allowing SME and instructional staff to review content to quickly completed products without the need for end-user testing.

Adaptivity. Being adaptive is key for instructional design models (Ritchie & Earnest, 1999). The adaptability of rapid prototyping is demonstrated in the ability for the model to be linked in to pre-existing traditional instructional design models. While implementing rapid prototyping, completely moving away from the ADDIE instructional design model is not always necessary. This flexibility is achieved due to rapid prototyping using the basic instructional system design pillars and implementing the pillars through a parallel development methodology (Nixon & Lee, 2001). Rapid Prototyping has also played a role in virtual learning environments (Nadolny et al., 2013; Shih et al., 2008; Tracey & Unger, 2012). Nadolny et al. (2013), Shian, et al. (2008) and Tracy and Unger (2012) leveraged rapid prototyping to solve problems within their localized context. When creating instruction within a virtual reality environment, Nadolny et al. (2013) credited the flexibility of rapid prototyping to the successful development of their product which provided the baseline structure. Shian, Tseng, and Yang (2008) created an entire wiki-based instructional system around the flexibility of rapid prototyping. Tracy and Unger (2012) were able to infuse rapid prototyping into another model and develop cross-cultural and unskilled workforce training under sever time constraints. Rapid Prototyping does not need to exist by itself but can function within the limitations of the operating environment.

Quality. Although being able to complete an instructional design project within time constraints is important, as is the quality of the product that is being created that truly matters. Although many products can decrease timelines, the production of instructional materials is typically adversely affected. Rapid Prototyping introduces a

system that can decrease timelines while often increasing the quality of instructional materials produced (Desrosier, 2011). Through the ability to develop several different prototypes, the ability to create additional innovations within the instructional materials is achieved based on the feedback individuals within the development process provide (Shih et al., 2008). Rapid Prototyping allows for instructors to create instructional products based on their abilities (Shian et al., 2008). This effort leads not only to quality instructional products but provides innovation within the instructional materials as well.

Successive Approximation Model

The SAM consists of two models, SAM I and SAM II (Allen & Sites, 2012). SAM implements an agile learning model philosophy by using iterative loops to create a product that becomes better with time. Agile philosophy is imbedded into SAM, where two iterations were created to better deal with the needs of the instructional designer, one for smaller projects known as SAM I and another for larger projects known as SAM II (Allen & Sites, 2012).

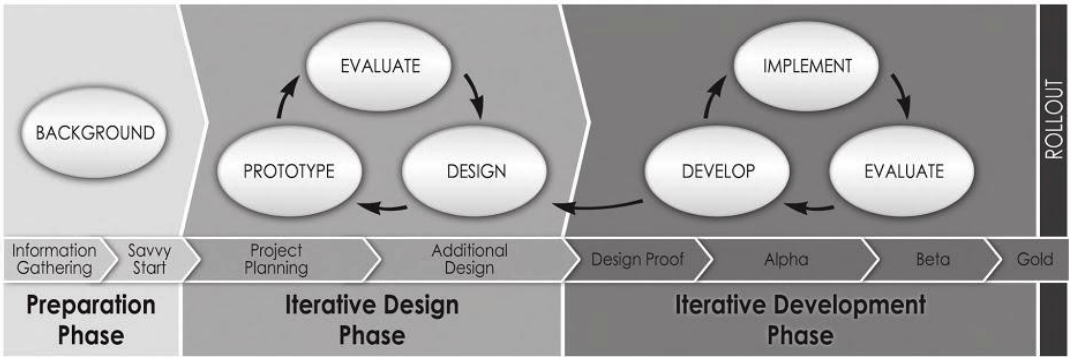
The use of iterative loops to create effective and efficient instruction is an essential philosophy for the Agile ADDIE Framework. Within SAM II, there are segmented systems between the design and development of products. The segmentation strategy within the instructional design model can be seen within the Agile ADDIE Framework with the separation between the development and sustainment phases. Furthermore, the modified role of assessing and evaluating instructional products from the traditional ADDIE model, along with the inclusion of prototyping, provided guidance during the development of the Agile ADDIE Framework.

Successive approximation model I. SAM I has three core milestones: (1) evaluate, (2) design, and (3) develop, which have been optimized for the simpler projects it is designed to support. The process, like SAM II, is iterative and is expected to go through multiple iterations until exiting the iteration cycle. When drawing parallels to the ADDIE process, it seems that the evaluate phase could very much draw ties to the analysis phase of the ADDIE instructional design model. During the initial evaluation phase of SAM I, the instructional designer should be conducting an initial analysis of the learners and problem while in further iterations, the focus is on the analysis on the past iteration (Allen & Sites, 2012). The design and develop phase also have similar roles to the ADDIE instructional design model. SAM I makes a marked difference from ADDIE, however, with the exclusion of the implementation and evaluation phase from its model.

Successive approximation model II. SAM II focuses on the larger projects, with a more detailed instructional design model as seen in Figure 2. Projects using SAM II start with a process called a savvy start, a meeting with all stakeholders to ensure the initial scope of the project (Allen & Sites, 2012). The process is then divided into two iterative cycles, a design phase and a development phase. Each phase of SAM II focuses on its respective area, but the two processes inform one another.

Figure 2

SAM II Model (Allen & Sites, p. 54, 2012)



As shown in Figure 2, both the design and development phases have three milestones, although the iterative cycle allows for the feedback to push a project between the design and development phases as needed for project development. This adaptive framework is key to SAM II's success, and an agile learning model fundamental (Clark, 2009). Prior to the implementation of a project that is being run through the SAM II model, a pilot cycle is conducted. The project is run through three prototype cycles that allow for further refinement of the processes, alpha, beta, and gold (Allen & Sites, 2012; Jung et al., 2019).

Studies on the successive approximation model. The SAM attempts to integrate the use of iterative processes to capitalize on process opportunities, which was foundational in the development of the iterative, assess, implement (IAA) cycle within the Agile ADDIE model. The studies of the SAM focused on the efficiency and flexibility offered by the model. It was clear there is an advantage from using the linear model of ADDIE, especially when looking toward modern workflows.

Efficiency. Traditional instructional design models such as ADDIE are outdated, and agile and iterative models are needed to help support the development environment (Ritchie & Earnest, 1999). When creating a program for augmented reality training within the healthcare industry, Carlson and Gagnon (2016) used the SAM model. This program used the SAM model based on its iterative design requirements, choosing it over traditional instructional design models which conduct a singular cycle (Carlson & Gagnon, 2016). When reviewing the eLearning environment in an attempt to discern the best methodology for creating online instruction, Jung et al. (2019) was discovered that the SAM Model II was not only more efficient but created a better instructional product when compared to other models. Jung et al.(2019) used all three of the pilot phases to ensure an iterative prototyping schedule as described by the alpha, beta, gold implementation cycle, supporting an iterative development effort.

Like rapid prototyping, SAM provides an efficient methodology to create instruction over traditional instructional design frameworks (Roth, Turnbow, Goldman, & Friedman, 2016). Roth et al. (2016) identified the need for a streamlined framework when attempting to build a scalable mobile library event. When identifying the rational for not choosing ADDIE for the instructional design project and, instead, opting to use the SAM I model, Roth et al. (2016) specifically identified ADDIE's lengthy process as key to deciding to use the SAM I's framework. Roth et al. (2016) chose to employ the SAM I model to create a scalable instructional event within a restricted timeline. Roth et al. (2016) also identified that given the time constraints within the development process, the

decision to use the ADDIE model would have made completing development of the learning event "impossible."

Flexibility. With SAM, organizations can choose to employ either SAM I or SAM II depending on the needs of the project. SAM demonstrates the flexibility of the model though the use SAM I for smaller products and SAM II for larger products (Allen & Sites, 2012; Carlson & Gagnon, 2016; Roth et al., 2016). ADDIE does not have this flexibility built into the system, which can cause inefficiencies. The interactive process of SAM I and SAM II is meant to be flexible and dynamic to the environment (Allen & Sites, 2012).

Implications for the Study

The ADDIE model has been identified in the literature as being inflexible, inefficient, and ineffective when compared to rapid prototyping (Tripp & Bichelmeyer, 1990) and the SAM (Allen & Sites, 2012). Agile learning models, specifically rapid prototyping and SAM, represent an opportunity to infuse the ADDIE model to create a hybrid between the two different types of instructional models. Rapid Prototyping has already been infused into the ADDIE model by Nixon and Lee with consequential results on their development (2001). The infusion of rapid prototyping opens an opportunity for a shift within the ADDIE instructional model, helping bring the ADDIE in line with the need for rapid and adaptable instructional models identified by Ritchie and Earnest's Delphi study (1999). This study will use the agile elements and concepts identify within both SAM and rapid prototyping to enable ADDIE to the efficacy of development cycles and quality of the overall Training Support Packages.

CHAPTER 3

METHODS

Chapter 3 will discuss the methodology used in the Agile ADDIE Framework mixed methods action research projects. First an overview of the setting that the Agile ADDIE Framework research was conducted in will be provided to give context to the research design, and methods. After the setting has been reviewed, the procedure, to include the data collection instruments, will be presented. Third, the Agile ADDIE Framework intervention will be described, to include its implementation. Lastly, the data collection and data analysis procedures will be identified.

Setting

In September 2019, the Agile ADDIE Framework was implemented within the VHA SimLEARN in Orlando, Florida. Within SimLEARN, the National Simulation Center is responsible for development and deployment of simulation-based training to VHA employees across a wide array of medical disciplines. At the time of implementing the Agile ADDIE Framework SimLEARN offered nine courses with a varied audience including doctors, nurses, and healthcare professionals.

SimLEARN consisted of three main branches, the National Simulation Center, the SimLEARN Outreach Network, and Resuscitation Education Initiative. The National Simulation Center was responsible for creating curriculum in the form of Training Support Packages to be used at the National Simulation Center, as well as throughout the VHA network. The SimLEARN Outreach Network provides onsite functionality for simulation-based instruction that the National Simulation Center creates to be taught to

healthcare providers at VHA locations. Finally, Resuscitation Education Initiative provides Advanced Cardiac Life support and Basic Life Support to clinics and Hospitals throughout the VHA. These different departments work as distribution channels for the Training Support Packages.

The National Simulation Center currently offers both the TTT and the TTP modalities. The courses range from conducting advanced medical procedures to providing healthcare providers with an understanding of how to implement simulation and instructional best practices. Typically, the National Simulation Center has been able to have six to seven courses in development at any given time.

Courses generally take on three different development states, new development, major sustainment revisions, or small sustainment revision. New developments are brought to the National Simulation Center for development through an intake process involving a learning consultant and the national project management office. During the assessment of the course, the course is put forward to the SimLEARN Education Committee and the committee will either accept or decline the proposed course. The committee consists of several associate directors, a program manager (PM), an instructional designer (ISD), and a simulation technologist (SimTech). Once a project has been assessed as something that the National Simulation Center would like to develop based on the needs assessment produced by the instructional designer, the course will have an ADDIE Working Group (AWG) created around it. The project will officially begin once the PM creates a project charter to identify the stakeholders as well as the

resources for the course and it has been accepted inside of a business intelligence software system the Veteran Health Administration.

Participants

A non-probability convenience sampling was be used during this mixed methods action research study. When developing the instructional program, an AWG was established. All members of the Agile ADDIE Framework AWG were targeted participants for the study, six (n = 6) of which agreed to participate in the focus groups and pre and post-intervention interviews. No courses were pre-selected for the Agile ADDIE Framework intervention, and no AWG participants were selected or assigned outside of the typical AWG selection process based on availability. The Agile ADDIE Framework was implemented on the first available course assigned to the National Simulation Center for new development, which was the Musculoskeletal Course for Emergency Department (MSK-ED). All research participants signed a consent form and were aware of the different data collections methods used throughout the study.

Figure 3

Table of ADDIE Working Group

Acronym	N	Title	Brief Summary of Role in AWG
Client	1	Client/Stakeholder	Representative to whom the product is being created for.
PM	1	Program manager	Manages time, money, resources.
ISD	1	Instructional Designer	Responsible for development and Maintenance of Curriculum.
	1	Course Director	Responsible implementation within operational environment.
Evaluator	1	Evaluator	Responsible for creating the evaluation criteria.

SME	4–5	Subject Matter Expert	Provides domain specific content, assists in the content creation.
EdTech	1	Education Technician	Assists in creation of content.
SimTech	2	Simulation Technologist	Provides simulation subject matter expertise.

The AWG consisted of approximately 13 members, six (n = 6) agreed to participate in pre- and post-intervention interviews and focus groups. Due to the flexible nature of the AWG, SMEs were often available for shorts intervals throughout the project's lifecycle. The members of the AWG included the PM, instructional designer, course director/lead faculty, an evaluator, the director of the national program office, and various SMEs from across the Veteran's Administration. All AWG members were targeted for the Agile ADDIE Framework research.

The AWG members ranged in their educational backgrounds although each were chosen for the expertise from peers in their professions or endorsed by the national program office as a participant. All participants were over the age of 18 and were geographically located throughout the United States. When the AWG met, they did so through Skype meetings, and were present locally as much as possible.

Within the AWG, the PM was ultimately responsible for the project and acquisitions of products and contracts. The ISD and learning consultant were responsible for the development and overall health of the instructional products. SMEs were responsible for providing domain knowledge and expertise in clinical knowledge while the SimTech's provided subject matter expertise in the creation and implementation of scenarios. Although the exact number of SMEs for this study varied throughout the

development process, several remained on from the kickoff meeting until the conclusion of development. Finally, the educational technician facilitated the process, taking meeting notes, and assisting in preparing instructional templates.

In addition to the AWG for the course, a non-probable purposeful sample was used to select no fewer than four instructional design SMEs (n = 4) to assess the course development outcomes. SMEs were required to have at least 3 years of experience creating products using formal instructional design processes, and at least a master's degree in instructional design from a regionally accredited institution. A more generalized master's degree in education was accepted if the subject matter expert has at least 5 years of formal instructional design experience. The instructional designers were required to have experience and be knowledgeable of how at least one government institution creates instructional materials and how lesson plans are utilized at the federal level within one government entity through past experience.

Role of the Researcher

During the study, the researcher was integrated into the AWGs as an instructional designer. This placed the researcher as an observer, participant, collector of data, and trainer when needed. Over the past year the researcher has advocated for integrating agile principles within the National Simulation Center development processes and is considered by many a resource for instructional design related information. During research project the researcher was promoted to Associate Director for Training during the post-intervention interviews. Prior to the promotion, the research was the most senior instructional designer at the National Simulation Center. The perception of authority in

the instructional design domain matter may be present and may lead to some inherent bias by participants. This potentially perceived bias will need to be observed throughout the intervention process.

The researcher conducted the one-on-one interviews with coworkers. In some cases, the coworker relationship has exceeded a year. During the interviews the researcher payed particular attention to the interviewees body language and voice vitality for participants looking to be led and annotated any occasions of perceived bias in body language or voice vitality. To further attempt to discover any bias, an exploratory questioning technique was used in the semi-structured interviews with narrative questions.

As an observer, the researcher kept a journal to identify how the intervention was implemented. The journal was later used to provide a contextual understanding for the coding as well as understanding the timeline of events during purposeful reflection. Observation did not just focus on the research process, observations were also focused on how the Agile ADDIE Framework was being implemented and its artifacts from a technical standpoint.

Instructional designers play a pivotal role in the development process. During all phases of the Agile ADDIE Framework that the researcher directed, developed, and assisted development of instructional materials. As the instructional designer the research also lead the kickoff meeting and conducted a basic overview of the process with all stakeholders.

The role of the research differed with the SMEs when reviewing the materials. The researcher remained a resource and point of reference to answer questions and provide materials. Additionally, when one SMEs asked a question the researcher sent the answer to all the SMEs so that the information was distributed throughout the team.

Procedure

All new program initiatives or major sustainment effort accepted by the National Simulation Center had the opportunity to have the Agile ADDIE Framework applied to it, but the study followed one AWG through the development process. Current sustainment efforts, ongoing courses, or courses with a pre-existing AWG were not included based on the level of disruption the intervention would have on ongoing processes, as well as how difficult it would be for participants to determine the impact of the intervention from its inception of the project. Leadership at the National Simulation Center were very aware of the intervention, and fully supported its implementation based on the results of previous, smaller interventions that occurred during previous cycles of this research.

Participant Recruitment

Prior to the intervention being implemented at the National Simulation Center, training occurred with all the PMs to educate them on the usage of the Instructional Design Management (ID MGT) binder, how to plan work between meetings, the importance of the ID MGT binder for development and audit purposes, and resources they can use if they have trouble. The training also went over how to use the different features such as cards, its intent, and how it should be briefed to AWG members. As a

backup to the PMs, the researcher was available to assist with any issue that were had with the ID MGT binder.

Recruitment of individuals for the study was done through a briefing prior the start of the kickoff meeting. Consent was be obtained before any involvement of participants in the study though a written letter either handed to them in person at the kickoff meeting or sent to them through email for review during the meeting. Potential participants that were unable to be seen face-to-face were briefed over the phone and/or through Skype. Everyone selected for the AWG was be given the opportunity to participate. Due the research background within the population, there was heavy support for research initiatives. Populations were set by the individuals available to the AWG, and therefore recruitment outside of the AWG was not possible.

The researcher was present for every AWG meeting. Being present at every AWG meeting allows for meeting notes and any needed training to be recorded. The ID MGT binder was reviewed once a week to ensure the overall health of the project. Data for both the ID MGT binder notes as well as the SCRUM burndown rate were collected during this time.

Outcome

To evaluate the outcome of the Agile ADDIE Framework, and to fully explore line of inquiry for research question two, the outcome of the implementation of the Agile ADDIE Framework was reviewed by external SMEs. External model validation, specifically field validation, were used to review the products of the Agile ADDIE Framework (Spector, Ohrazda, Van Schaack, & Wiley, 2005).

Once the training support package was developed using the Agile ADDIE Framework, a participant package was sent to pre-selected participants to measure the outcome of the model. Each participant was provided with two Training Support Packages, one created with the standard ADDIE instructional design process and the other with the Agile ADDIE Framework, and instructions. The instructions included how to fill out the evaluation tool, although it did not go into incredible depth as the level of expertise of the participants is considerable. Within the instructions the timetable, communications instructions, participation expectations, and package inventory sheets were present.

Participants were sent the Training Support Packages using a Google Drive link to provide ease of use for downloading. For those unable to receive the file through the Google Drive link, other accessibility options were be offered. Once the participants had downloaded the files, it was requested that they return the Training Support Packages within 15 days of receipt with the evaluation forms filled out.

No explicit training occurred on how to fill out the evaluation form, due to the knowledge level and expertise of the SMEs. Questions were answered as the researcher received them, and the answers were then be distributed to all the SMEs as they were answered. A modified evaluation form was placed in the Google Drive for each participant after one of the participants had trouble selecting numerical values. Once the evaluations were complete, the participants uploaded the files back into the Google Drive folder.

Intervention

To increase the efficiency of the instructional design processes at the VHA National Simulation Center, and the ADDIE process in general, a modified ADDIE framework was implemented.

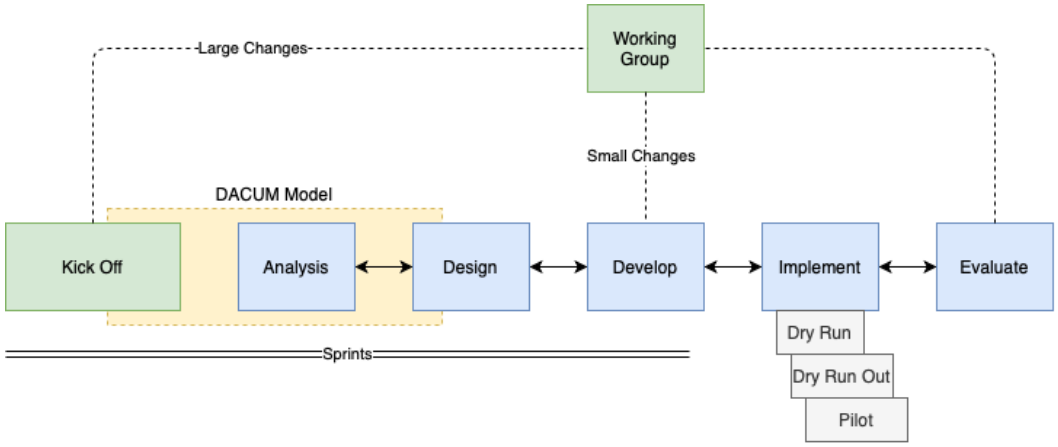
Framework Development

To develop the Agile ADDIE Framework several iterative models were built. A frosted glass window on the backside of an office was used for templating, and individuals were asked not just what they thought was good about the model, but what could be done better. Individuals were often asked to be hypercritical of the model and try and break the model efficiencies with hypothetical situations.

The initial framework was created, as seen in Figure 4, with the ADDIE model being built with feedback loops and some early concepts of increasing flexibility. It was also important to ensure that the model stay anchored to the traditional ADDIE model, as the traditional ADDIE model is required to be used in many of the perspective intervention sites. The concept of multiple iterative pilots was also leveraged in the implementation phase.

Figure 4

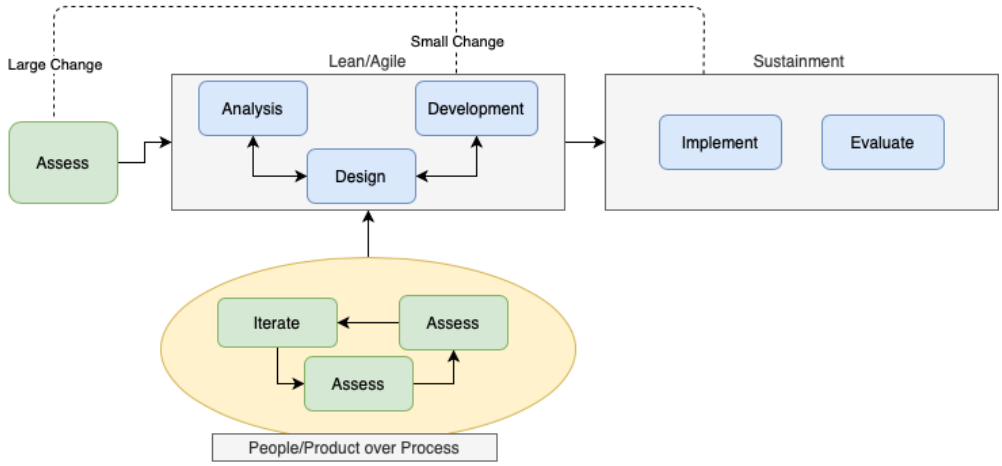
Initial build of the Agile ADDIE Framework



The feedback that was received from the initial model was that there were some great concepts in the initial draft, but the introduction of just feedback loops does not solve some of the major issues with speed and quality that are present in the traditional ADDIE model. The waterfall methodology, where one step must be complete before moving to the next, was still a blockade to progress to move quickly through the process. The second build implemented several additional improvements, to include the IAA cycle and the concept of different phases grouped by functionality.

Figure 5

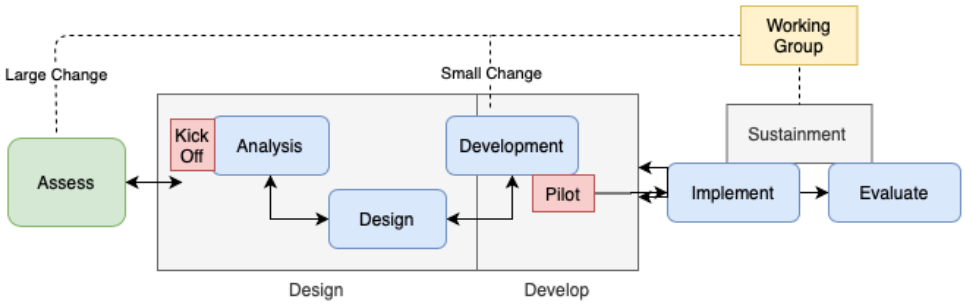
Iterative build # 2 Agile ADDIE Framework



The second iteration had the core concepts of what would become the Agile ADDIE Framework embedded in the intervention, but the balance between the different elements was incorrect. During the second iteration, the concept of being prescriptive on steps of the process began to take shape. The prescriptive steps can be seen in Figure 5 below the assess block where specific steps were drawn out. The concept of being prescriptive in the different steps was further elaborated on in the third iteration of the intervention as seen in Figure 6.

Figure 6

Iterative build # 3 Agile ADDIE Framework

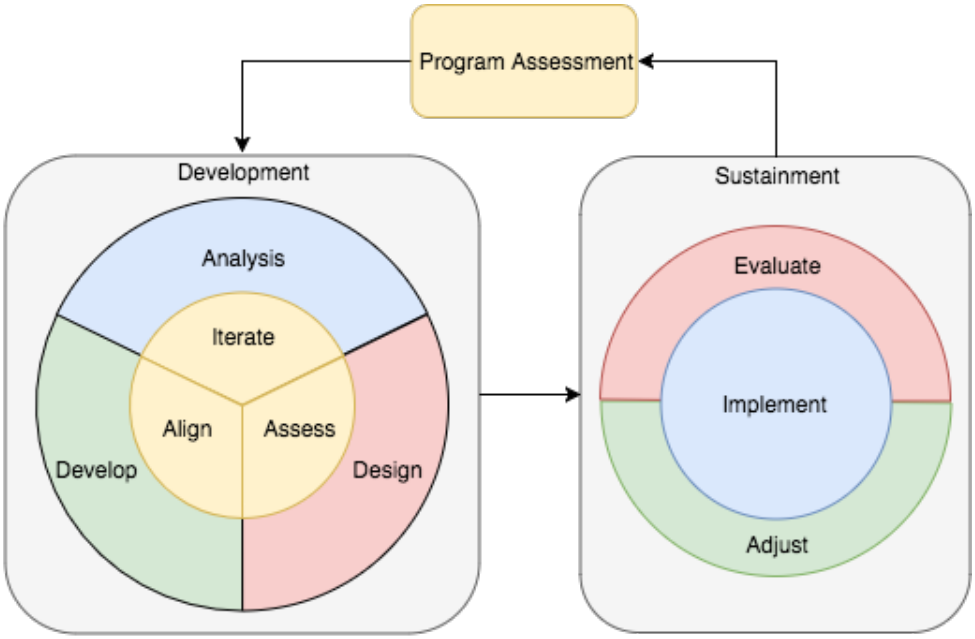


At first, the use of a model appeared to be the most efficient way to solve many of the gaps in traditional ADDIE model. Earlier iterative versions of the framework were built from a model mentality, as seen in iterations one, two, and three. After looking at the previous iterations, it was apparent that the iterative models were becoming increasingly prescriptive, which would be a blockade to implementation. A framework which allowed for the contextualization would to be easier to implement, as there would not have to be adjustments to the framework itself. Rather, the framework could sit on top of local instructional design process. The change in perspective encouraged the model to be simplified, making it congruent with the goals of the intervention when it was first was started.

Between iterative build three and four (Figure 6 & 7) the concept of a framework really took hold. It was identified that controlling the movement from one phase to the next and being as prescriptive as possible it's actually counterintuitive, and against the core values of remaining agile.

Figure 7

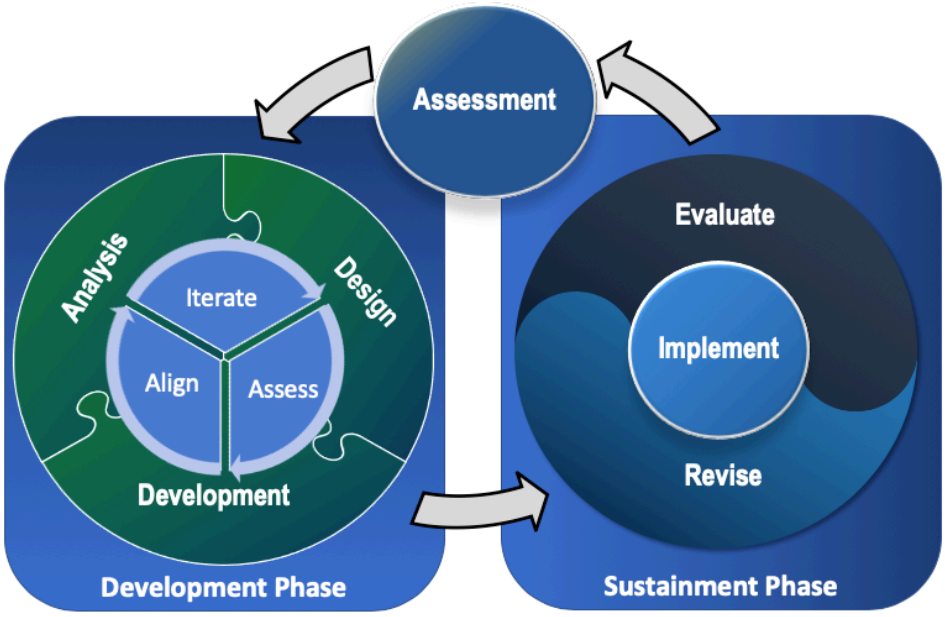
Iterative build # 4 Agile ADDIE Framework



The Agile ADDIE Framework. The modified ADDIE framework adjusted the ADDIE model from a linear, waterfall instructional design model to an adaptable and agile model. Rather than switching out the ADDIE model for an entirely new model, which would take considerably more organizational effort and mindshare, the adjustment of the ADDIE model was chosen due to the quick adaptation time, as well as pre-existing institutional knowledge to the basic ADDIE concepts within departments. As seen in Figure 8, the Agile ADDIE Framework uses elements from the SAM, RPM, and the agile framework (Allen & Sites, 2012; Manifesto, 2010; Tripp & Bichelmeyer, 1990). It should be noted that there seems to be confusion at the industry level between iterative development and agile development, with iterative design being used in place of truly agile development methodology.

Figure 8

The Agile ADDIE Framework



The Agile ADDIE Framework was developed following a literature review of problems from the field. As this has been the case with several instructional design models in the past, there was initially a heavy heuristic approach and socialization with peers and SMEs (Lee & Jang, 2014).

Training on the intervention occurred during the first sit-down meeting with the AWG to discuss expectations of the course, and how the course would be developed. The training consisted of a presentation that included an overview of the agile ADDIE process, question and answers, and took participants through a high-level overview of the development process and expected deliverables that are standard to most instructional design processes. This training was recorded in the meeting minutes by the educational technician. Additional training was offered on a just-in-time basis for participants during, and between, the AWG meetings that occurred on a biweekly basis, which was a decision

that was made during the kickoff meeting. No training was provided outside of the initial meeting.

Program assessment. Although the traditional ADDIE model starts with the analysis phase that consists of items, such as a task analysis, the separation of the analysis phase and project assessment allows for organizations to first identify whether they will accept the project before devoting massive resources (Clark, 2015b). Depending on the organizational needs, a needs assessment and general overview of the proposed training gap can be done, avoiding the misallocation of time and resources. The program assessment also enables stakeholders to be identified, and for organizations to provide criteria and equipment on their perceived training gap. It should also be noted that after a program is delivered, programs will use the program assessment as a vehicle to assess and change the program.

Kickoff meeting. The kickoff meeting is a critical part of the Agile ADDIE Framework. Typically, the kickoff meeting helps establish a project charter, discuss the needs assessment, and provide a briefing on how the development of the project will occur. Although it is preferable to have all members of the AWG present and at the same geographical location, realities often make this difficult and therefore need to be conducted through teleconference. The kickoff meeting will explain the deliverables for the instructional program, and how deliverables will be adjusted throughout the process even after the initial deliverables due to the agile approach that is taken. If enough resources are available, the AWG can likely move into the analysis and possible design sections of the overall ADDIE process. This part of the intervention is informed by the

SAMs savvy start meeting, which uses an initial meeting to build prototypes and objectives as quickly as possible in the initial concept creation processes, specifically during the initial meeting (Allen & Sites, 2012).

Development. The development phase consists of four elements; analysis, design, develop, and the IAA cycle. Although the analysis, design, and develop phases are parts of the traditional ADDIE model, the agile ADDIE model makes the typical linear cycle fluid in nature with the inclusion of the IAA cycle. Another agile element that is implemented in the development phase is the instructional design management binder (ID MGT binder), which utilizes the agile based methods of SCRUM and KANBAN boards. Both IAA cycle and the ID MGT binder were developed through heavy influence from both SAM and RPM, with the overall goal of achieving a more agile system (Allen & Sites, 2012; Fichtner, 2012; Schwaber & Sutherland, 2013; Tripp & Bichelmeyer, 1990). It should be noted that all deliverables are working documents until development of the project is completed, as the IAA cycle may force the AWG to go back and adjust presumptions about the analysis of design throughout the process.

Analysis. Although the Agile ADDIE Framework is fluid, it should start in the analysis phase. The analysis phase of the ADDIE model is incredibly important and sets the rest of the course up for success. An improper analysis can lead to significant issues of the instructional product, and even lead to possible failure. The Agile ADDIE Framework lowers the risk to the overall project due to the ability to revisit the analysis as needed, but an emphasis should be given to a proper analysis in order to ensure the correct gap is being filled. Deliverables for this section often include a Front-End

Analysis and an evaluation strategy. It is important for organizations to remember not to put too much emphasis on paperwork that will not be used for the benefits of the process. For the intervention at the National Simulation Center, a Front-End Analysis will be produced at the initial conclusion of this phase.

Design. The design phase of the ADDIE process focuses on building learning strategies, learning objectives, evaluation tools, and identifying the flow of the course. Many of the design phase objectives provide an opportunity for rapid prototyping, and many can be done during the analysis phase to further inform and align both phases. During the design phase, the skeleton of the course is made, and for the purposes of this intervention at the National Simulation Center, an instructional design document will be produced at its conclusion.

Development. During the development phase much of the subject matter and domain knowledge is placed into the delivery strategies that were decided within the design phase. During the development phase of the Agile ADDIE Framework, pilots will also be conducted. At the National Simulation Center, pilots are full fidelity courses that are carried out with at least half the expected sample student population in the expected environment the course will be held. Traditionally, pilots have been done during the implementation phase (Clark, 2015b). Pilots are a critical feedback loop that must be part of the development phase, as feedback will often change and inform the products that are created, and therefore have been moved to reflect the nature of their role in development. At the conclusions of the development phase, a product that is ready for implementation should be able to be handed to the instructional team to implement.

IAA cycle. The IAA cycle implements elements form rapid prototyping and the simplified SAM I model (Allen & Sites, 2012; Tripp & Bichelmeyer, 1990). The goal of this process is to have individuals produce prototypes with varying levels of fidelity, assess those products for meeting their stated objective, and then align the product and process with the overall goal. During the development of the program, the IAA cycle functions on a deliverable level to allow the AWG to move to within the process to update documents and align process for what makes the most sense for the project. The IAA cycle identifies the need for a formal framework to exists, but empowers teams work fluidly within that framework to further empower the AWG to make decisions that are best for the project. The prototypes of deliverables also allow for the minimum amount of planning documents to be created before moving into the development phase, further speeding up the cycle of development. The IAA cycle also does not restrict subject matter expert creativity, as the IAA cycle allows for individuals to jump to different sections of the process to further inform preceding elements.

ID MGT binder. The instructional design management (ID MGT) binder provides agile fundamentals at the AWG level, and allows for planning in a fluid environment. In short, the ID MGT binder is a collection of documents the runs the day-to-day operations of the development of the curriculum, keeping track of who has to do what, and identifying the priorities. The ID MGT binder framework focuses on using meetings, or 'sprints,' to control work scope, prioritization, coordination, and maintain the initiative on the project, a framework that is typically associated with a SCRUM project management technique (Schwaber & Sutherland, 2016). For the ID MGT binder, the

SCRUM framework is further supplemented by the KANBAN project management framework. The influence of KANBAN limits the number of tasks that can be 'in progress' at any given time and decreases a reliance on meetings (Al-Baik & Miller, 2014). Because AWG members have extremely busy schedules, the ID MGT binder enables individuals to not have to participate in meetings but still progress on tasks, with the PM managing the sprint cycles.

Instruments and Data Sources

A mixed method action research approach was taken for this study. Both quantitative and qualitative data sources were triangulated to answer the research questions. RQ1 examines the implementation of the Agile ADDIE Framework, while research question two evaluates the outcome of that process using the merlot peer review evaluation form.

Qualitative Measures

The qualitative measures that were collected were pre and post-intervention interviews of participants of the AWG, focus groups, and the weekly structured reflections. Focus groups were held at the conclusion of each sprint, or approximately every two weeks throughout the implementation of the Agile ADDIE Framework. The weekly structured reflections were done weekly throughout the Agile ADDIE Framework, and were not associated with the sprint cycle.

Interviews. To measure the perceived impact the Agile ADDIE Framework had on overcoming lengthy development time, inflexibility, and resource constraints, semi-structured pre- and post-intervention interviews were conducted. During the pre-

intervention interview participants were asked about their current perceptions of the traditional ADDIE model. When conducting the post-intervention interviews with the AWG team members, participants were asked to describe how they felt the intervention improved flexibility, timeliness, and efficiency with resources. The focus of the post-intervention interview questions was the perceived impacts the Agile ADDIE Framework had on development.

There were two types of interviews that occur: (1) face-to-face interviews and (2) telephone interviews. Face-to-face interviews were the preferred method, and telephonic interviews were only be conducted when it was not feasible for the interview to take place in person.

The semi-structured interviews were broken down into two sections, a general section that was asked during the pre and post-intervention interviews, and an intervention specific section which was only asked during the post-intervention interviews (see Appendix A). The first section, general, identifies how the ADDIE or Agile ADDIE Framework was able to function in the development cycle from the macro viewpoint. The general section further asks common questions about time, resource constraints, and flexibility.

The interventions section focused on specific elements of the Agile ADDIE Framework. The following question topics were part of the intervention sections: the program assessment, the kickoff meeting, the IAA cycle, and the ID MGT Book. Each question was asked in a narrative manner about the impact on development, and then

followed up with specific questions about the impact on time, resource constraints, and flexibility.

Focus groups. The focus groups were held at the conclusions of each SCRUM, to collect data from the participants on their perceptions throughout the development cycle. Although the focus group was held in person for many of the participants, some individuals were joined by a Skype call. The participants were asked three narrative questions focused on the speed in which the course was being developed, the flexibility of the development effort, and how the development process was handling resource constraints (see Appendix B). The researcher facilitated the discussion between members of the AWG to ensure that everyone had an opportunity to speak. The focus groups were scheduled to occur every two weeks, but at times needed to be adjusted due to scheduling conflicts or unforeseen natural events, such as a hurricane.

Weekly structured reflections. A semi-structured journal was maintained by the researcher to further explore research question one. The data collected through the weekly structured reflections provided an opportunity for the researcher to contemplate on the real-time implementation of the intervention in an authentic environment. Throughout the research, the researcher reflected on four questions that revolved around time, resources, flexibility, and the general development progress (See Appendix C).

Quantitative Measures

Quantitative measure included a SCRUM burndown, which is was stored in an excel spread sheet. The SCRUM burndown kept the actual vs prescribed or planned rate

of productivity on a biweekly basis. This measured how productive sprints were, and the development outcomes in comparison to what was projected.

SCRUM burndown. There was a biweekly points list that provides the goal of the biweekly period between meetings, which was recorded inside of a spreadsheet. The second item that is recorded is the actual amount of points that were able to be completed. The measurement used was one point was recorded as an estimated hour of work that was needed to complete a task. By comparing goal performance versus actual performance, the understanding of efficiency and progress was identified. Underperforming and over performing burn rates were compared to the qualitative data and provided insight into what went well and what did not go well. Additionally, the SCRUM burndown rates provided the total timeline data for comparison to the average course development times at the National Simulation Center.

Mixed Measures

The Merlot Peer Review Form is an instrument used by the Multimedia Educational Resource for Learning and Online Teaching (Merlot) organization to evaluate curriculum that is provided on their website ("MERLOT Peer Review Information," n.d.). The data collected through this instrument was used to answer research question two. The evaluation standards provided both qualitative and quantitative areas for input and came with a guide to help scoring, as seen in Appendix D. The first section of the document is information disclosures and inventory of the curriculum Training Support Packages. The second section of the documents consists of three main areas: Quality of Content, Potential Effectiveness as a teaching tool, and ease

of use. Each section contains several questions with a 5-point Likert scale, and concludes with a qualitative question of strengths and weaknesses of the reviewed area. The Merlot Peer Review Form also provided a general overview area where a Likert scale value is provided and other comments about the materials are documented.

As seen in Table 1, data collection lasted for approximately seven months, with a month of preparation. There was also a month delay between when the project course had been selected and when data collection could begin based on the National Simulation Center's commitment to other projects.

Table 1

Flow of Procedures

Timeline	Actions	Procedures
May 2019	Finalize all Data Collection	• IRB approval Received
June 2019	The MSK-ED course selected for intervention Prepare Documentation Set up ID MGT binder	
July 2019	Assessment Complete Project Accepted by the National Simulation Center Participants identified	• Consent forms distributed and collected
August 2019	Kickoff Meeting SCRUM/Sprint Meetings Needs Assessment Complete	• Conduct pre-intervention Interviews • Conduct Focus groups & collect notes • Record SCRUM burndown rate • Review ID MGT binder

		• Record Weekly Structure Reflections
September 2019	SCRUM/Sprint Meetings Needs Assessment	• Conduct Focus groups & collect notes • Record SCRUM burndown rate • Review ID MGT binder • Record Weekly Structure Reflections
October 2019	Continue Data Collection Development Cycle	• Conduct Focus groups & collect notes • Record SCRUM burndown rate • Review ID MGT binder • Record Weekly Structure Reflections
November 2019	Continue Data Collection Development Cycle	• Conduct Focus groups & collect notes • Record SCRUM burndown rate • Review ID MGT binder • Record Weekly Structure Reflections
December 2019	Continue Data Collection Development Cycle	• Conduct Focus groups & collect notes • Record SCRUM burndown rate • Review ID MGT binder • Record Weekly Structure Reflections
January 2020	Course Materials Completed Recruit reviewers	• Conduct post-intervention Interviews

		● Send out Merlot Rubric & Instructions with Training Support Packages to SMEs for Peer Review on all Finished Products

Data Analysis

A mixed method approach was be taken with the study. Research Question 1 was primarily answered through the use of qualitative data, although the ID MGT binder burn rates provided quantitative data that was used to answer the research question. Conversely, research question two gathered information from the Merlot Peer Review Form, which mainly consisted of quantitative measures, although narrative responses were also collected to provide a more well-rounded understanding of the full context to the participants answers. An overview of the analysis per research question can be seen in Table 2.

Table 2

Flow of Procedures

Research Question	Measure	Analysis
"Process" RQ 1: How does using the Agile ADDIE Framework in development working groups in nontraditional learning environments help overcome the perceived issues of: a) Lengthy development time b) Inflexibility during development	a) Interview Question Coding 1–4, 8–10; Burn Rate, Focus group Question 1, Weekly Structure Reflections question 1 & 4	● Grounded Theory/Coding, Triangulation with Descriptive statistics from burn rate
	a) Interview Question Coding 1–3,5, 8–10, Focus group Question 2, Weekly	● Qualitative Coding/Grounded Theory

c) Resource constraints during development	Structure Reflections question 2 & 4	
	b) Interview Question Coding 1–3,6, 8–10, Focus group Question 3, Weekly Structure Reflections question 3 & 4	● Qualitative Coding/Grounded Theory
"Output" RQ 2: How, and to what extent, does implementing the Agile ADDIE Framework affect the quality of developed materials in nontraditional learning environments?	Likert scale Categories on the instrument include: Quality of Content ● Potential Effectiveness of teaching tool ● Ease of use ● Overall Rating	● Coding/Theming Qualitative analysis for narrative responses ● Descriptive Statistics for

Research Question 1

When conducting the analysis on the perceived impact of the Agile ADDIE Framework on the development process for research question one, a mixed method approach was used. The development research question addressed three separate areas of inquiry, lengthy development time, inflexibility during development, and resource constraints during development. In general, researching the qualitative analysis process underwent open coding, axial coding, and category coding processes as the information was collected, which is described by the grounding theory process (Corbin & Strauss, 1990). Analysis was assisted through the use of MAXQDA 2020 Transcription and Coding Data Software.

Focus group data was analyzed during the intervention, first using open coding to understand the data, then further refining the codes with axial coding to understand the

relationship between the codes, and the codes were then further categorized. The same analytical process was then used to review the weekly structured reflections and the pre and post-intervention interviews. After the coding process was complete, the themes from the weekly structured reflections, the pre and post-intervention interviews, and the focus groups were triangulated and analyzed to develop a broader based contextually aware theme. The analysis process was ongoing and continuous. Early concepts of themes were identified and inform the analysis of subsequent iterations.

Lengthy development time. Although the same analytical process was used for each area of inquiry for the development research question, the 'lengthy development time' line of inquiry has a mixed method component. The SCRUM burn rate, which identifies how fast projects are being completed in comparison to how fast participants believe they can complete a task, was used in the analysis. Analysis occurred using descriptive statistics, specifically looking at a comparison between projected performance and the average speed that courses are completed by the National Simulation Center. The burn rate provided contextually relevant data to be triangulated with coded themes and provide further insight into the experiences of the participants.

Research Question 2

The quality of the products produced using the Agile ADDIE Framework were examined in research question two. A mixed method approach was used in the analysis of the Merlot Peer Reviewer Report Form. The instrument uses both narrative text fields as well as a Likert scale. The narrative fields provided an opportunity for open coding analysis. Due to the brevity of the answers provided within the narrative fields, open

coding provided a thorough analysis of the provided answers. The information from the coding was triangulate with the results from the Likert scale analysis. The Likert scale analysis will be evaluated using descriptive statistics on several questions focused on the educational values of the product that.

Validity. It must be acknowledged that the smaller sample size represents the largest risk to the study, specifically to external validity and generalizability. It should also be noted that the lack of generalizability is a common with action research (Bradbury-Huang, 2010). To mitigate some of the risk and increase the internal validity of the study, triangulation was implemented through the use of multiple data sources, as seen with both the ID MGT binder, pre- and post-intervention interviews, and focus groups for research questions one. To further increase the validity of the study, member-checking was implemented at the conclusion of the study with the AWG members to ensure an accurate portrayal of the experiences (Creswell & Creswell, 2005).

Although the researcher's presence within the intervention is common in action research, the presence of the researcher may impact the results. During the research, the researcher eventually became the direct supervisor of several of the participants and fell within a leadership position within the National Simulation Center. To mitigate any influence, the research ensured to empathize that there were no right or wrong answers during interviews and focus groups. The researcher also had an inherent biased toward seeing that the research had a favorable outcome based on the development of the Agile ADDIE Framework, and being the instructional designer in the project. The researcher

disclosed their role in the research, and their involvement in the creations of the mode to all participants during the kickoff meeting.

CHAPTER 4

DATA ANALYSIS AND RESULTS

Chapter 4 is organized on the basis of the research questions that were explored during the Agile ADDIE Framework research. During the research, both qualitative and quantitative data was collected while answering the following research questions:

RQ 1: How does using the Agile ADDIE Framework in development working groups in nontraditional learning environments help overcome the perceived issues of:

- Lengthy Development Time
- Inflexibility During Development
- Resource Constraints During Development

RQ 2: How, and to what extent, does implementing the Agile ADDIE Framework affect the quality of developed materials in nontraditional learning environments?

The qualitative data collected during the study included weekly structured reflections, pre-intervention interviews, focus groups, and post-intervention interviews. These qualitative sources were used to directly answer RQ 1. For RQ 1, a SCRUM burndown chart was also used to collect quantitative data on the time for course development. The pre-intervention interviews were administered from September 18th to 19th, 2019, prior to the implementation of the intervention. Throughout the research study, the researcher conducted weekly structured reflections that were repeated until the conclusion of the development process. Focus groups were held at the National Simulation Center at the conclusion of each SCRUM meeting, which was approximately every two weeks with the exception of holidays, weather, or illness preventing meetings

from taking place. The post-intervention interview was administered from February 5th to10th, 2020, after the conclusion of the development process. The quantitative data will be presented first, followed by the qualitative data.

Data collection for RQ 2 involved the Merlot Peer Review Form, which collected both qualitative and quantitative data from SMEs. The Merlot Peer Review Form was provided to nine participants on February 11th to 26th, 2020, with a 15-day period to respond. Of the nine participants, four responded and completed the evaluation of two courses. As with the previous section, the quantitative data will be presented first, followed by the qualitative data.

RQ 1. Data analysis was conducted through the use of open coding to identify initial concepts and themes throughout the data that was presented. Following the identification of specific concepts throughout the pre-intervention interviews, post-intervention interviews, structured reflections, and focus groups, the open coding was grouped to form concepts that transcended individual codes. This process is often referred to as axial coding. After the axial coding, a categorical review of the codes was conducted to discover relationships between different codes. After the conclusion of the coding, MAXQDA 2020 was used to provide a visualization of the data that was collected.

RQ 2. Descriptive statistics and a t-test were used on the scores that were provided within the Merlot Peer Review Form quantitively sections. Opening coding and thematic analysis was conducted for the qualitative data. MAXQDA 2020 was used for

the open coding and thematic analysis. The quantitative data will be presented first, followed by the qualitative data.

Results

Results for Research Question 1

Qualitative data was selected for this research question to explore the perceived impact that the Agile ADDIE Framework had on the participants when in the development cycle. A SCRUM board burndown chart was also used to provide quantitative data on how the intervention was performing. Overall, 42 codes were identified and grouped into six categories.

Table 3

Description of Qualitative Sources

Data Source	Word Count
Pre-Intervention Interviews	16,424
Weekly Structured Reflection	8,051
Focus Group	7,653
Post-Intervention Interviews	22,484
Total Word Count	54,612

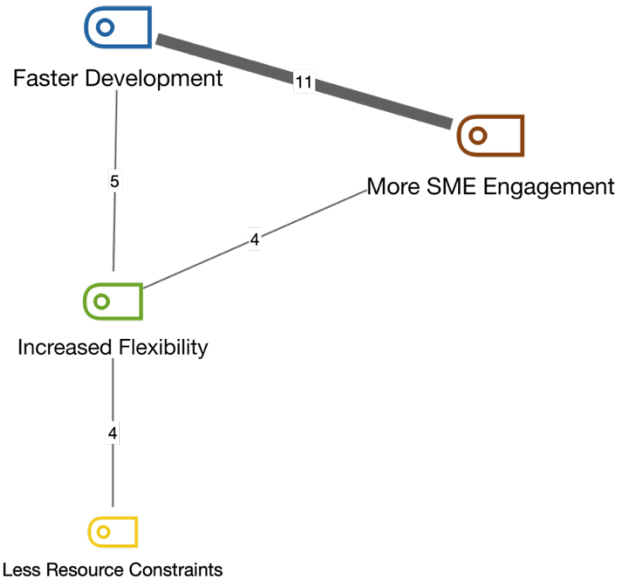
As documented in Table 3, there were several sources of qualitative data that were collected when answering RQ 1. The structured journal entries provided a contextual understanding of the researcher's reflections while using the Agile ADDIE Framework. In addition to the weekly structured journal reflections, the focus groups provided feedback on how the participants were feeling about the perceived variables within the

Agile ADDIE Framework. The focus groups provided a wealth of information, as participants could reflect their feelings and perceptions of the process in real time throughout the course development. The pre-intervention interview and post-intervention interview provided a context and framework in which the participants were able to summarize their experiences.

In addition to the coding process described earlier, modeling was also completed with the data to further visualize the data. As seen in the Theme Co-occurrence Model (see Figure 9), the visualization data provides relational insights into how the different codes are contextually relevant. Modeling and visualization of data also assisted in the categorization of themes and understanding their interconnected relationship. Three themes that emerged from the Agile ADDIE Framework research are faster development, increased flexibility, and fewer resource constraints when implementing the Agile ADDIE Framework.

Figure 9

Theme Co-Occurrence Model



SCRUM burndown. SCRUM is not an acronym but rather a specific set of methodologies used to describe a specific project and program methodology. The SCRUM methodology employed during the Agile ADDIE Framework included a SCRUM board and sprints. The SCRUM board was used to coordinate taskings and ensure a constant flow of communication between AWG members. The sprints were biweekly meeting that occurred to address the course status, progress, and issues with the project. The SCRUM burndown log was a record of how long it took complete taskings associated with the development process and was updated at the end of every sprint, or biweekly meeting.

The SCRUM burndown was compared to the National Simulations Center's average time to complete a moderate difficulty course. The average course completion time was developed by curriculum developers at the National Simulation Center, using historical context to develop a generalized benchmark on the time it took for a course to

be completed. The benchmarks were not created using any quantitative data from previous course development, due to the complexity of every project being unique. The SMEs that were asked to complete the average time to complete a course including the researcher and two other instructional designers with over 20 years of combined experience. The average timeline created to complete a course was under the industry standard for the development of simulation (Clark, 1995). Although the average timelines are higher than some industry standards, the nature of the industry, the nature of the modalities, and the availability of resources increases the total number of days required to complete a development project.

Table 3

Complexity Calculator and Agile ADDIE Framework Performance

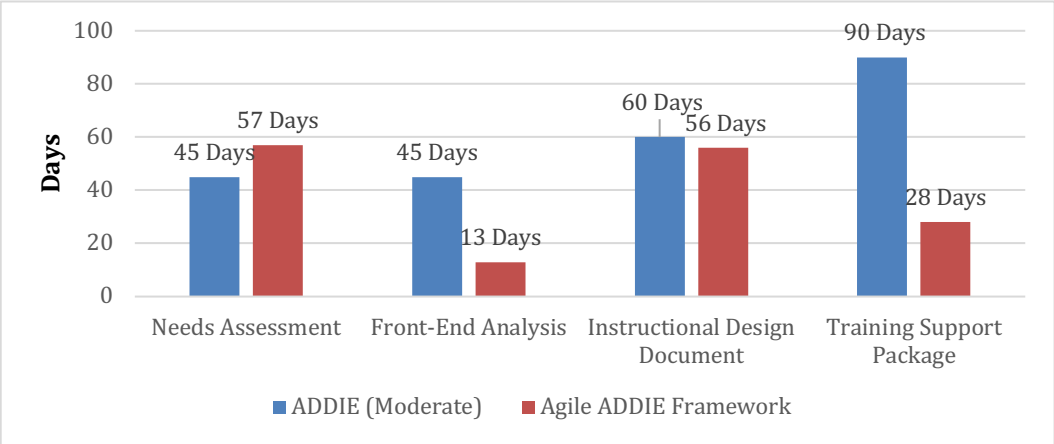
Deliverable	Agile ADDIE Framework	ADDIE model (Moderate)	Delta
Needs Assessment	57 Days	45 Days	+12 Days
Front-End Analysis	13 Days	45 Days	-32 Days
Instructional Design Document	56 Days	60 Days	-4 Days
Training Support Package	28 Days	90 Days	-62 Days
Total	154 Days	240 Days	-86 Days

As seen in Table 3, a standard ADDIE model linear project takes 240 days to complete. The Agile ADDIE Framework took a total of 154 days from the initiation of the assessment to the identification that the development was complete. The Agile ADDIE Framework was 86 days quicker in total to deliver the course. It should be noted that during the development process Thanksgiving, Christmas, and New Year's was a

factor within the development process and were counted toward the days of the development cycle. Regardless of these holidays, the Agile ADDIE Framework still performed faster than the standardized model.

Figure 10

Agile ADDIE Framework Comparative Performance



As seen in Figure 10, the Agile ADDIE Framework outperformed in each benchmark except for the needs assessment. Due to the increased need for a refined assessment of requirements, the Agile ADDIE Framework appeared to spend more time during the analysis phase, but the time was then reduced in the Front-End Analysis and throughout the development process. The information shown in Figure 10, corroborates the information provided through qualitative analysis that the Agile ADDIE Framework was not just perceived as faster, but was actually developed faster than the typical traditional adding model by 86 days.

Faster development. During the initial analysis of time, several codes co-occurred with the theme of time being faster when using the Agile ADDIE Framework. The IAA cycle had the strongest co-occurrence with time, and further analysis revealed a

theme between speed and the IAA cycle. The IAA cycle enabled work to be completed on several areas of the process at the same time, increasing the speed of development.

Table 4

Component, Themes, and Assertations for Time

Component	Theme	Assertation
1. The IAA Cycle increases the speed in which courses are completed. 2. The IAA cycle enabled SMEs to work on multiple deliverables at the same time. 3. The IAA cycle enabled working in multiple areas of the development product within the same time.	The IAA cycle enabled work to be completed on several areas of the process at the same time, increasing the speed of development.	The IAA cycle increases the perceived speed in which a course is developed.

The IAA cycle increases the perceived speed in which a course is developed. *The IAA cycle allowed for work to be completed on several areas of the process at the same time, increasing the speed of development.* Participant responses to the focus groups, pre-intervention interviews, post-intervention interviews, and weekly structured discussions identified that (a) the IAA cycle increased the speed in which the course was completed, (b) the IAA cycle allowed for SMEs to work on multiple deliverables at the same time, (c) the IAA cycle enabled working in multiple areas of the development product within the same time, and (d) one part of the cycle often informed other parts of the development process.

Table 5

Definition, Explanation, and Examples for Time

Definition	Explanation	Examples
The IAA cycle allowed for work to be completed on several areas of the process at the same time, increasing the speed of development.	The IAA cycle assigned participants work based on opportunities within the process, to include working on training deliverables as soon as the needs assessment was completed. The creation of training products so early in the process allowed for an iterative approach that informed the analysis and design training deliverables. The development of training deliverables informed concepts in the analysis and design phase based on SME and client feedback, which expedited the development of the deliverables as well.	"They made it a faster process, more complete, and took into account a lot of different factors simultaneously that then fed each other" (Participant ANG9511, during the post-intervention interview). "Well, I think it's developing at lighting speed" (Participant NOR3864, during a focus group during the second focus group). *"*I think it was fast, for sure. It was, I don't know about statistical, but it's probably at least twice as fast as a similar project would have been otherwise" (ANG9511 during the post-intervention interview). "When we're in that kind of design, development phase in the IAA we had some critical information that we needed to be able to move forward into moving on into the other areas," (Participant BRE9834 during a post-intervention interview when asked to reflect on

	the impact of the IAA cycle). "A draft front-end analysis and instructional design document are being worked on at the same time" (during weekly 8 structured reflection on the IAA cycle).

The post-intervention interviews suggested that the IAA cycle facilitated a faster development process. Encouraging participants to work on draft deliverables that can be assessed and aligned within the standard development process ensured that SMEs' efforts were not overlooked in the process. The increased engagements were partially due to the ability to contribute. "There is still also some pieces that need to updated and reflected on but our subject matter experts seems ready to react immediately to the needs of the project. In the past there was frustration by IPT members but here there is no frustrations that can be seen" (During Week 21 structured reflection). The adjustment from having the process dictate progress to having participants efficiently leverage their time made the participants perceive the process as fast.

Participants indicated that they thought that the ability to work on multiple deliverables at the same time increased the speed of the development process, which is a key component of the IAA cycle. There was also a perception that the development process was fast based on the IAA cycle during the post-intervention interviews. "… we have several people on the team that they have different duties they were able to

accomplish this in an efficient way," (Participant YAD0309 during the post-intervention interview when asked about the IAA cycle).

In the post-intervention interview and focus groups, participants also suggested that using parallel development, whereby two products are developed at the same time, increases the speed at which the development process is completed. Having individuals work training support package deliverables while also working on design documents, allowed for changes to be made in all areas of the development phase of the Agile ADDIE Framework. "Being able to tackle multiple aspects in the development at one time is time-saving, and efficient," (Participant ANG5911 identified during the seventh sprint meeting).

Participants also shared that the ability to work on end-state deliverables during the very beginning of the development process, and progressively improve the quality and relevance of products based on feedback provided by the group, which increased the speed in which final development product was able to be produced. The allowance for the deliverables to be adjusted regardless of what was predominantly being developed provided SMEs with the confidence that things may change even after discussions had ended. It was also identified that the ability to change different items throughout the process also increased the speed in which the course was able to be completed. "The project framework continues to remain flexible with individuals being able to react to changes and adjustments on the fly," (Noted in Week 16 of the structured weekly reflection).

Flexibility. When discussing flexibility regarding the Agile ADDIE Framework, the discussion focuses around the ability to contextually adjust to process to mitigate threats to the project and take advantage of opportunities. Flexibility interacted with the productivity of the Agile ADDIE Framework, the SCRUM methodology, and SME engagement resulting in several themes. When asked about the flexibility of the Agile ADDIE Framework, and its effect on the development process, participants overwhelmingly identified the Agile ADDIE Framework as more flexible (see Table 6).

Table 6

Component, Themes, and Assertations for Flexibility

Component	Theme	Assertation
1. The flexibility of the process made the development effort more efficient. 2. Flexibility enabled resilience within the development cycle. 3. Integration into linear acquisition systems remained efficient due to flexibility. 4. Developers being able to work on multiple items at the same time.	The flexibility in the Agile ADDIE Framework increased productivity.	Flexibility within the Agile ADDIE Framework increased the perceived productivity due to the ability to move around the process as needed.
5. Enabled the possibilities of changing something further down the development pipeline made people comfortable to move forward.	The flexibility of the Agile ADDIE Framework enabled the ability to conduct quick fixes and updates to development efforts.	

6. Allowing constant changes to all parts of the development process allowed for constant improvement.		
1. The SCRUM boards allowed for access to everything which enabled the flexibility to work with all. 2. SCRUM Board consolidated communication to provide a more efficient solution. 3. SME involvement was expeditated due to Sprints and SCRUM boards.	SCRUM methodology enabled agility throughout the development process.	Flexibility helped increase SME engagement through leveraging the SCRUM methodology.

Flexibility within the Agile ADDIE Framework increased the perceived productivity due to the ability to move around the process as needed. *The flexibility allowed for an increase in productivity.* Pre-intervention interviews, post-intervention interviews, focus groups, and weekly structure reflections identified that flexibility increased the overall perceived productivity courses are completed because: (a) the flexibility of the process made the development effort more efficient, (b) flexibility enabled resilience with the development cycle, (c) integration into linear acquisition systems remained efficient due to flexibility, and (d) developers being able to work on multiple items at the same time.

Table 7

Definition, Explanation, and Examples for Flexibilities Impact on Productivity

Definition	Explanation	Examples
The flexibility in the Agile ADDIE Framework increased productivity.	Flexibility enabled the development process opportunistic progress and resilient to risks. Being able to work on, and adjust, deliverables within all phases of the analysis, design, and development made progress always achievable.	**"**I think that flexibility is probably the key to this piece. 'cause as I said, you take it off the assembly line, and you move it into parallel work and this allows you to kind of bounce back and forth, and overall be more efficient," (Participant ANG9511 in a post-intervention interview). "Flexibility remains the biggest driver of progress," (Week 7 weekly structured journal entry). "So, it's like the game stays the same, the players will change. So during this process, we lost a PM, we're gaining a new one, but you might get a little wrinkle in the fabric, but we still have to press on. And I think that's one thing that I like about this, it's designed to have that flexibility and that's what it should be," (Participant KAR3741 shared during their post-intervention interview).
The flexibility of the Agile ADDIE Framework enabled the ability to conduct quick	During the development process initial products and assumptions changed. The flexibility in the Agile ADDIE	"Again, to me the (agile) ADDIE process is great because you're constantly reassessing during the process. Because a lot of

fixes and updates to development efforts.	Framework ensured that content creators could move throughout the process and adjust items as needed. There was no lock-in to content after review.	times we may have a great idea, but when it comes to implementation there may have to be adjustments made," (Participant EEI1677 during the post-intervention interview). "I think, the flexibility is good because, again, the communication is there consistently. And being able to tackle multiple aspects in the development at one time is time-saving, and efficient," (ANG9511 during the seventh sprint). "It is interesting to note that based on the fact that everyone is aware things could change, participants are less likely to argue about the fine details and are accepting to see how things work out further down the line," (Week 2 of weekly structured reflections).

Participants reported that the ability to adjust content as needed increased their productivity. "… the process in place it just kind of forces you to constantly be on the move and constantly thinking, "Okay, what's next? What do we need to do to get to the next step?" (EEI1677 shared during their post-intervention interview when asked about reacting to needs). The weekly structured reflections identify that flexibility increased productivity and allowed for rapid development of courseware by empowering the participants to identify which lead to the project always making progress. Participants

also identified working within the Agile ADDIE Framework was more efficient due to the ability to make decisions quickly due to the flexibly to react to the decision points brought up in meetings.

Participants identified that the flexibility of the Agile ADDIE Framework made it more resilient to external threats, such as with the loss of the PM or the evaluations support personnel. The development process was also resilient to AWG members not attending the biweekly SCRUM meeting, or new SMEs joining the development team midway through the development of courseware. "Again, that spoke to the flexibility of the (Agile) ADDIE process, because in the event that it was instructors that could not attend, or we were expecting shortfalls as far as equipment or anything like that, that was easily identified and we were able to make adjustments as the situation arose," (EEI1677 during the post-intervention interviews).

The Agile ADDIE Framework was flexible enough to overcome barriers with integrating into linear processes. Linear process, such as acquisition, are those process that are similar to the traditional waterfall model of the ADDIE model. Participants initially expressed concern over the timeline for the acquisition cycle, a traditionally linear process. Due to Agile ADDIE Framework's flexibility, the process was able to adjust itself around the threat to the project. As identified in a weekly structured reflection, "The process has been extremely flexible, so much so that it has been able to develop around other linear processes. We have been able to overcome issues because as the issues arise, we are able to adapt to those issues to find solutions because there are more variables to play with. A great example of this is the acquisition or budgeting

process. We were able to revise and refine our outcomes based on limitations that may be present" (Week 23 weekly structure reflection).

The flexibility of the Agile ADDIE Framework enabled the ability to conduct quick fixes and updates to development efforts. Pre-intervention interviews, post-intervention interviews, focus groups, and structured weekly reflective journals suggested that the flexibility of the Agile ADDIE Framework enabled (a) the possibilities of changing something further down the development pipeline made people comfortable to move forward, (b) enabled the possibilities of changing something further down the development pipeline made people comfortable to move forward, and (c) allowed constant changes to all parts of the development process ensuring constant improvement.

Participants reported that the ability to work on several items in a nonsequential manner expedited their ability to deliver development products. Parallel development, the specific agile methodology added to the Agile ADDIE Framework, was identified as a specific measure taken that participants perceived made the course development faster. Participants felt the ability to move forward in the development cycle while analysis or design was being developed allowed for more than one thing to happen at the same time, which differed from the process without this agility.

The weekly structured reflections also suggested that participants seemed to be progressing quicker through tasks knowing that permanence was not required at the end of each development task, and then the ability to change previous work to accurately reflect the current state was a quick process. "It is interesting to note that based on the fact that everyone is aware things could change, participants are less likely to argue about

the fine details and are accepting to see how things work out further down the line," (Week 2 weekly structured reflection). Participants also reported that the ability to constantly improve collective efforts expedited the willingness of what could be shared and collaborated on.

The ability to create quick fixes for items that were being worked on in the development cycle was prominently identified by participants during focus groups and post-intervention interviews. Participants identified the ability to change project items after they had been developed or to react to elements within analysis, design, or development provided reassurance to the participants and allowed progress to be made without perfection. "So this way we were able to kind of adjust pretty rapidly as things go on," (Participant ANG9511 during their post-intervention interview when reflecting on the ability to adjust development products).

Flexibility helped increase SME engagement through leveraging the SCRUM methodology. *The SCRUM methodology enabled agility throughout the development process.* Pre-intervention interviews, post-intervention interviews, focus groups, and structured weekly reflective journals identified that the SCRUM boards enabled the process to be more flexible due to the following components: (a) the SCRUM boards allowed for access to everything which enabled the flexibility to work with all, and (b) SCRUM boards notified AWG members of progress through the framework.

Table 8

Definition, Explanation, and Examples for flexibility

Definition	Explanation	Examples

SCRUM methodology enabled agility throughout the development process further increasing productivity.	Productivity was increased based on the ability to opportunities the were presented due to the flexible nature of the framework, such as using SMEs in a just-in-time fashion.	"So, again, I don't have to stop what I'm doing to make a phone call, to send an email. I could actually just go right there to the SCRUM board and reach out and get any answers that I needed. So again, that brought a different level of flexibility to everyone that was involved in the project." (Participant EEI1677 post-intervention interview). "I actually think it was beneficial because I think that everybody that had access to it, everyone else knew when a change was made and could go in and review it, it kept the master safe being that any changes were documented," (NOR3864 during a post-intervention interview discussing SCRUM board). "The way the course or the project has been designed, it allows for people to join the team even though the project already started" (Participant YAD0308 stated during Week 5 focus group).

The SCRUM board specifically enhanced the flexibility of the Agile ADDIE Framework based on the asynchronous manner in which participants were able to interact

with course development materials. Being able to access the development materials asynchronously created an environment where meetings could be postponed or eliminated altogether. Participants during post-intervention interviews identified that the SCRUM board was able to supplant email or phone calls and allowed for the SMEs to be integrated directly into the project without delay. In another post-intervention interview Participant YAD0308 stated "Well, no, no, actually it was really flexible because of the access of the documents and the interaction with people."

The consolidation of documents also took place on the SCRUM board. Participants reported that the speed was increased due to the ability to interact with the board in an asynchronous manner. "… so people will know where to find stuff just by going to one place instead of going through their emails. Which is what typically all we do when using ADDIE," (Participant YAD0308 during their post-intervention interview). The ability to work asynchronously also ensured more efficient leveraging of SME availability. The structured weekly reflections also showed that the SCRUM boards allowed for progress to be made without having sprints present. The level of engagement observed, and shared, by the participants was evident, with participants sharing that progression was being made outside of organized sprints and was attributed to the SCRUM methodology by the participants.

Participants identified the impact SCRUM methodology had on the productivity throughout the development process. "I feel that it saved time. As I said, is that being able to look at that to keep up with what was going on as the process went through it," (Participant NOR3864 during a post-intervention interview). With the introduction of the

SCRUM board into the development environment, participants communicated more openly and often based on the information that was available. The introduction of sprints into the Agile ADDIE Framework, a biweekly meeting that occurred throughout the cycle of development, also ensured that AWG members were present and able to coordinate efforts. Participants stated that SCRUM boards allowed for better communication, which also helped ensure that SMEs were more involved engaged in the development process. During a post-intervention interview Participant EEI1677 suggested "If we didn't have the SCRUM board, then again, it's relentless phone calls, it's emails, it's waiting on someone to return a phone call or an email. All of that was reduced with using the Microsoft 365 and the SCRUM board."

Participants reported that the SCRUM methodology increased the flexibility of the development framework that allowed for onboarding in new individuals without significant delay midway through the development effort. "So, bringing in SMEs during the development process, when we already started, that makes the development process really flexible," (Participant YAD0308 during the Week 5 focus group). The flexibility of the Agile ADDIE Framework also helped engage members who were entering the AWG after the development had already begun.

The perceived increase in productivity was greatly enhanced by the involvement of SMEs reacting to the flexibility of the Agile ADDIE Framework. The SMEs involved were more likely to engage in tasks and be part of self-organizing groups. Participants shared that the engagement by SMEs was critical to the success, and flexibility, in which the course was able to be completed. During the post-intervention interviews, participants

stated that the speed that was achieved was partially due to the enthusiasm that the SMEs showed throughout the development process. The sense of urgency was further described by participants in the structured journal entries. Participants self-created groups to continue to make progress regardless of whether meetings were taking place to align efforts, "That being said, it does appear that with the changes in the schedule, the program is still able to progress, to include having individuals contribute to the process that would otherwise be stagnant with self-organizing teams," (Week 7 weekly structured reflection).

The flexible environment that the Agile ADDIE Framework provided enabled a concept where SMEs were able to define tasks on their own based on the needs of the program. The self-organizing teams were a great example of SMEs defining tasks and the needs to complete them. The weekly structured reflections identified that being able to remain flexible within the workflow allowed for tasks to be completed that weren't yet identified on the SCRUM board but needed to be done further down development timeline. "The self-organizing teams allows for tasks to be completed within the timeframes that have been set and work that is not prescribed is also being completed," (Week 15 weekly structured reflection entry).

Resources. Resources were a critical element throughout the development process and were defined as items enabled the development and implementation of a course. Personnel and simulation equipment were the most referenced resources. Participants identified that the kickoff meeting played a large role in identifying resources requirements and constraints. During the focus groups, post-intervention interviews, and

weekly structured reflection, participants identified that no constraints were encountered throughout the process, as demonstrated in Table 9.

Table 9

Component, Themes, and Assertations for Resources

Component	Theme	Assertation
1. The Kickoff meeting provided an overall view of the project resource constraints. 2. The AWG came together based on the kick of meeting to sit down and discuss what the course needed.	The kickoff meeting allowed for a quick and early identification of purchase requirements.	The Agile ADDIE Framework allowed for the AWG to start acquisitions much earlier.
1. Increased amount of SME availability, a typically restricted resource. 2. There were no acquisition constraints on the project.	No constraint came up at any time throughout the development cycle.	There were no constraints after implementation of the Agile ADDIE Framework.

The Agile ADDIE Framework enabled the AWG to start acquisitions much earlier. *The kickoff meeting allowed for a quick and early identification of purchase requirements.* As the first major event in the Agile ADDIE Framework, the kickoff meeting was an opportunity to help set expectations for the project. Participants identified that (a) the Kickoff meeting provided an overall view of the project resource constraints, and (b) the AWG came together based on the kickoff meeting to sit down and discuss what the course needed.

The kickoff meeting enabled the initial identification of resources that would be required for the development of the course. In the post-intervention interviews participants identified that the kickoff meeting was a critical juncture where it was possible to project resources that would be required to develop and implement the course. The early identification of the resource requirements included personal and equipment restrictions, and the group was able to react to the restrictions early in the process.

Participants also reported that the participation of SMEs was greater during the kickoff meeting then what is expected in a traditional development cycle. The inclusion of all AWG members provided an environment in which collaboration occurred. The collaborative effort, which included the National Program Office and SimTEchs, was perceived to be a best practice of the development effort.

Table 10

Definition, Explanation, and Examples for resources

Definition	Explanation	Examples
The kickoff meeting allowed for a quick and early identification of purchase requirements.	During the kickoff meetings participants were able to identify the requirements for the project's development and the implementation of the course. The discussion was critical to understanding the development needs, and ensured that the required resources were requested so to not slow the timeline.	"I think it was good to have clarification in the kickoff meeting, on identifying some of the potential constraints early in the process." (HSI5527 during a post-intervention interview) "But with the kickoff meeting, it allowed everyone to come to the same table and then identify whether it was financial restraints, whether it was equipment restraints, or

		even personnel constraints." (EEI1677 during a post-intervention interview) "In terms of the kickoff meeting, I think, again we had an overall view of what resources would be needed so we kinda start to plan some of those things out." (ANG9511 during the post-intervention interview)
No constraint came up at any time throughout the development cycle.	Throughout the post-intervention interviews, and the focus groups, participants identified that there were no resource constraints, something that is not typical to the development process as identified in the pre-intervention interviews.	"Right now, there are no constraints, but I foresee that it may be somewhat of a challenge to work," (KAR3741 during the fifth focus group) "One of the highlights, I believe was, again, focusing on the instructors and those instructors that were able to be a part of the program, just having their expertise and seeing how they were able to gel through the process." (EEI1677 during a post-intervention interview)

There were no constraints after implementation of the Agile ADDIE

Framework. *No constraint came up at any time throughout the development cycle.* Throughout the development cycle no constraints were identified that would inhibit the development process. Participants suggested that the impact the Agile ADDIE

Framework had on resourcing was: (a) increased amount of SME availability, a typically restricted resource, and (b) there were no acquisition constraints on the project.

The impact the Agile ADDIE Framework on the perceived SME availability increased. The ability to immediately engage SMEs ensured that SME time was not a resource constraint, but actually a development asset. “Subject matter experts have been added and the ability to use them immediately has been fantastic, with their input being leveraged,” (Week 11 Weekly Structured Reflection).

At no point during the development process was the ability to acquire resources restricting to the participants. Participants in the focus groups identified that there were no resource constraints during the development of the project, as well in post-intervention interviews. Several participants did identify that there was a risk to the timeline because of how long it takes for contracts to be approved. The course was able to take advantage of pre-existing contracts, and if those pre-existing contracts were not in place, the development timeline would have increased, or resource constraints would have been evident. Participants identified that the ability to foresee the resource requirements such as contracting costs allowed for the course to reduce and limit the risk of the project.

Results for Research Questions 2

Within RQ 2, there was the goal of answering whether a higher quality of product that was being produced from the Agile ADDIE Framework. To answer this question to Training Support Packages were compared to one another. The first training support package was the MSK-ED course, which was developed using the Agile ADDIE Framework. The second course was the Maintenance of Certification in Anesthesiology

(MOCA) course to represent the traditional ADDIE model. MOCA has been in operation for approximately a year at the National Simulation Center and has the benefit of undergoing several small changes to the training support package.

The Merlot Peer Review Form was used to collect both quantitative and qualitative data, with a major emphasis on quantitative data to answer the question of quality of a product being produced. The four participants reviewed the curriculum which took approximately one hour for each course. As seen in Table 11, participants rated the intervention, the agile ADDIE course, higher in each category of the Merlot Peer Review Form. It should be noted that research question two focuses on the quality of the product being produced, one of the three metrics that is evaluated on the collection tool. The additional two sections of the Merlot Peer Review Form provide additional context to how the model produced content, regarding its effectiveness as a teaching tool and its ease of use for instructors.

Table 11

Descriptive Statistics

	Course	N	Mean	Std. Deviation	Std. Error Mean
Quality	ADDIE	12	4.28	.38	.11
	Agile ADDIE	12	4.86	.16	.05
Effectiveness	ADDIE	9	4.18	.37	.12
	Agile ADDIE	9	4.70	.23	.08
Ease of Use	ADDIE	8	4.25	1.36	.48

Agile ADDIE	8	4.53	.99	.35

Quality. As seen in Table 12, an independent two-tailed t-test was conducted to compare the quality of the course created using the traditional ADDIE model to the Agile ADDIE Framework. Four instructional designers identified that the course created using the traditional ADDIE model ($M = 4.86$, $SD = 0.38$) was rated significantly higher in quality when compared to the MOCA course ($M = 4.28$, $SD = 0.11$; $t\ (22) = -4.81$, $p = 0.00$). The *t*-test results for quality suggests that the Agile ADDIE Framework produces a higher quality product than the traditional ADDIE model. Table 12 provides the t-test statistics for all three categories that were rated by SMEs.

The qualitative data collected on the Merlot Peer Review Form identified that the four reviewers felt the Agile ADDIE Framework course was better quality than the course created by the traditional ADDIE model. Participants felt that the Agile ADDIE Framework course provided content in a logical manner, with "very strong instructional design" (BAR2216). In contrast, the four instructional designers had concerns about the learning objectives created using the traditional ADDIE model. Participants also felt that there was not enough information on the slides depending on the who the instructors were.

Table 12

T-Test for Quality

Levene's Test for Equality of Variances	t-test for quality of means

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Quality	8.02	.01	-4.81	22	.00	-.58	.12	-.82	-.33
Effect	.50	.49	-3.60	16	.00	-.52	.15	-.83	-.21
Ease of Use	.27	.61	-.43	12.79	.65	-.28	.59	-1.56	1.01

Effectiveness. The independent two tail *t*-test compared the course created using the traditional ADDIE model to the course created using the Agile ADDIE Framework in regard to effectiveness as a teaching tool. Four instructional designers identified that the Agile ADDIE Framework ($M = 4.70$, $SD = 0.23$) course was of significantly more effective as a teaching tool than the created using the traditional ADDIE model ($M = 4.18$, SD 0=.37; t (16) = -3.60, p = 0.00). The qualitative data collected on the Merlot Peer Review Form identified that the four reviewers felt the Agile ADDIE Framework course was more effective than the course created by the traditional ADDIE model. The Agile ADDIE Framework course was praised for the visuals used in the training support package and the scaffolding of concepts while also questioning the didactic heavy modality choices. In contrast, the traditional ADDIE model course had concerns of cognitive overload and the learning objectives while praising it logical flow of the content.

Ease of use. An independent two-tailed *t*-test also compared the course created using the traditional ADDIE model to the course created using the Agile ADDIE Framework concerning the use of the training support package within an operational

environment, or the ease in which the product was able to be used. Four instructional designers identified that there was not a significant difference between ratings of the course created using the Agile ADDIE Framework ($M = 4.53$, $SD = 0.99$) and the course created using the traditional ADDIE model ($M = 4.25$, $SD = 1.36$; $t\ (12.79) = -0.43$, $p = 0.65$).

The qualitative data collected on the Merlot Peer Review Form identified that the four reviewers felt the Agile ADDIE Framework course was easier to use than the course created by the traditional ADDIE model. The reviewers identified that Agile ADDIE Framework course was "Very clear and concise" (JUD1225). Concerns were raised by the participants about the lack of content within the traditional ADDIE model course, although it was also said to be "clear and easy to follow" (JUD1225).

CHAPTER 5

DISCUSSION

The purpose of this mixed methods action research study was to determine the impact of the Agile ADDIE Framework on the traditional ADDIE development process. Instructional design within the government, and specifically within the National Simulation Center, has been linear in nature and restricting the ability to build courses in an effective and efficient manner. To fully understand this problem of practice, literature was reviewed dealing specifically with instructional design, agile elements of design, and the crossroad in which instructional design and agile elements intersected. Literature on the SAM, rapid prototyping, and other lesser-known and implemented models were also reviewed for context and theoretical perspectives. Using the hermeneutic loop methodology, a framework was created using these theoretical perspectives, and iterative researcher reflection. Using the intervention framework, the Agile ADDIE Framework, a mixed methods action research study was developed to evaluate the impact of agile elements had on the traditional ADDIE model. The research showed that the Agile ADDIE Framework did indeed have a positive impact on perceived deficiencies in the ADDIE model development process while also creating a more effective and better-quality product.

Discussion of Results

The Agile ADDIE Framework demonstrated a substantial improvement over the traditional ADDIE model. This improvement was shown in two distinct areas, the development process and the course outcome. During the development cycle, the Agile

ADDIE Framework increased the speed in which courses were developed. The design was reported to be considerably more flexible, with higher SME engagement through SCRUM methodology, and was able to avoid resourcing constraints by using an iterative process to foresee potential issues or constraints.

RQ 1: Perceived Improvements to ADDIE

Research question one asked about the perceived improvements of the Agile ADDIE Framework in comparison to the traditional ADDIE model. The first research question was further divided into questions about speed, flexibility, and resource constraints. To answer the true impact of the Agile ADDIE Framework on speed, flexibility, and resource constraints, the relationships and connections between the themes are discussed.

Speed through flexibility. The Agile ADDIE Framework was perceived as faster by the participants in post-intervention interviews, the focus groups, and the weekly structured reflections throughout the development cycle. The Agile ADDIE Framework was so fast that individuals had actually identified the Agile ADDIE Framework as being too fast during one of the focus groups. After reviewing the SCRUM burndown log, it was clear that the Agile ADDIE Framework was not only perceived to be faster by the participants, but was actually faster when compared to the traditional timeline for ADDIE course development from the National Simulation Center. It should be noted that while the SCRUM burndown log identifies that the Agile ADDIE Framework created a course 86 days quicker than the projected timeline for a course at the National Simulation Center, the reliability of the calculator has not been established. It is through the

triangulation of data from the weekly structured reflections, pre- and post-intervention interviews, focus groups, and SCRUM burndown log that the perceptions of speed in the Agile ADDIE Framework is evident.

When analyzing what contributed to the increase in the perceived speed, the IAA cycle appeared to have the greatest impact. Flexibility was inherent in the IAA cycle, and meant less time in the traditional linear process. During the post-intervention interviews with participants, flexibility was often identified a leading contributor to speed.

SCRUM methodology and SME engagement also held a significant role in the perceived speed in which the Agile ADDIE Framework was able to complete a course. The SCRUM methodology enabled a more SME centric approach to development than the traditional ADDIE model provided. The use of biweekly meetings, and the use of the SCRUM board, were approaches that participants cited often in post-intervention interviews when asked about the speed in which the Agile ADDIE Framework was able to develop a course. Furthermore, the biweekly SCRUMs encouraged SMEs to take ownership of progress and process with self-defining teams. With the help of self-defining teams, SMEs took the initiative to complete remaining tasks that are were still pending, such as forming a team to write a scenario or review PowerPoints. It was clear that the SMEs had a stake in the outcome, and they felt that their contributions were directly impacting the project.

The self-defining teams ensured that even while the development process fell on major holidays, work was still completed. Because SME time is often the most coveted resource to leverage during a development process, having a way for SMEs to participate

regularly whenever they could, and involve them from the beginning of the development process, allowed far more interaction and engagement with SMEs, and reduced the constraints that were often encountered in the traditional model of development. Although SME engagement decreased the development time, it also increased the productivity of the course. Most of the productivity observed came from the flexibility of the framework. By implementing flexibility into the framework as a core tenant through SCRUM methodology and the IAA cycle, SMEs were able to be engaged immediately. The agile model also leveraged the use of parallel development, allowing for SMEs to work ahead of the process through rapid prototyping, and work without a linear process map.

Flexibility also allowed for a more resilient development cycle. During the development of this course, there was a loss of a PM, the evaluation manager, and the development cycle fell on a holiday season. These factors should have extended the timeline of course development significantly. Infusing SCRUM methodology into the core of the process, however, ensured communication remained constant despite changes and holidays. By emphasizing this common communication aspect, there was often the ability to plan ahead and ensure operational transparency. Operational transparency, where the status and intention of all development efforts is known and communicated to all team members, was critical to flexibility. The operational transparency allowed for the instructional designer, and the oncoming PM, to resume operations without disruption.

The two major influences on the Agile ADDIE Framework were the SAM and the RPM. Examples of the theoretical perspective of agile learning models, the Successful

Approximation Model, and RPM offered significant benefits based on previous research. Agile learning models typically are iterative, reactive to the contextual environment, and flexible (Clark, 2015b).

The increase in speed through flexibility is consistent with pre-existing research (Adnan & Ritzhaupt, 2018; Arimoto et al., 2016; Jones & Richey, 2000; Nguyen et al., 2016). Interestingly, although previous research had identified that the largest amount of saving was done in the analysis phase of the ADDIE process, that was not the case with the Agile ADDIE Framework (Desrosier, 2011). When looking at the development of the course, the time saved occurred in almost all areas of development except the analysis phase. The needs assessment took more time than the traditional ADDIE model, however, this seems to have translated into less time throughout the course development, because once the planning was done, all other aspects of development moved more efficiently, resulting in 86 days of less development time than the traditional model.

The research and theoretical frameworks validate and align with the results of the Agile ADDIE Framework. Previous research supports the outcomes of the mixed method action research project, with the exception of the analysis phase being the most time efficient. Specific elements within the Agile ADDIE Framework assisted with carrying over previous successes from research, specifically, the IAA cycle and the SCRUM methodology. These two types of methodologies were influenced by the rapid prototype model and SAM.

The use of sponsor and stakeholder-centric strategies, which were embodied by the IAA cycle and SCRUM methodology, insured that stakeholders were part of the

entire process. Stakeholder and sponsor centric strategies further align the results with the outcome with previous research. The core tenants of the agile elements help ensure that regardless of the specific implementation, many of the same themes are present in previous research as well as the outcomes from the mixed methods action research.

No resources constraints. The resource constraints were never substantially evident to any of the AWG members. Participants felt, for the most part, that there were no resource constraints. This is mainly driven from the reactive nature that the Agile ADDIE Framework was able to employ early in the development process. During the kickoff meeting, requirements were discussed, and storyboarding assisted with further identifying acquisition requirements. Based on the anticipated requirements for the development process, solutions, and possible resource restrictions such as new contracts were described to the entire group. The limitations and resource restrictions were then translated back into the overall design and development of the course, allowing for a reactive approach to the resource constraints.

In the weekly structured reflections, participants reported an ability to foresee resource constraints before they occurred. Resources like the availability of SMEs, acquisition of materials, or funding were able to be addressed early in the process due to this ongoing communication tool. Resourcing requirements for the pilot, as well as development requirements, were also identified during the kickoff meeting. It was evident that the Agile ADDIE Framework better utilizes resources such as SME time than the traditional ADDIE model, where SME time is often a key time constraint.

The agile process was significantly shorter in length and is credited in doing so by the involvement of stakeholders. The inclusion of stakeholders was a central theme behind the SAM, specifically the kickoff meeting that uses the savvy start methodology which was influential in the design of the kickoff meeting in the Agile ADDIE Framework (Allen & Sites, 2012; Arimoto et al., 2016). Agile elements appear to bring the stakeholders in to a central position within the development cycle up front, which occurred through the SCRUM methodology as well as the IAA cycle. These concepts are found in both the SAM and rapid prototyping, and have had similar results (Allen & Sites, 2012; Gawlik-Kobylinska, 2018; Tracey & Unger, 2012).

The results and theoretical frameworks are in alignment concerning the impact that agile elements have on resources. The kickoff meeting as well as the involvement of SMEs significantly altered the way the development process dealt with, and experienced, resources. The shift from development-centric strategies to stakeholder-centric strategies supports the existing literature, and the outcome confirms the impact that agile elements have on the stakeholders and SMEs.

RQ 2: More Effective and Better Quality

After the product was developed, the course was provided to four instructional designers to review, along with a course that was developed using the traditional ADDIE framework, and had gone through a year of course revision during its implementation. The agile ADDIE course was rated as significantly higher quality and more effective and more efficient as a teaching tool. Due to the rapid nature in which the course was developed, the result was even more surprising due to the fact that the traditional ADDIE

developed course had been revised for an entire year. The courses were rated as comparable on ease of use, although the qualitative data favored the Agile ADDIE Framework course.

To specifically address RQ2, the quality of the product that was created by the Agile ADDIE Framework was better. The quality of the product likely lead to the product being more effective as a teaching tool. Although the agile added framework scored higher for ease of use, it was identified that it was not statistically significant.

The increase in quality after integrating agile elements is consistent with previous research that identifies implementing agile elements into an instructional design model will increase the quality of content delivered (Chaiwut, 2015; Jung et al., 2019; Nguyen et al., 2016). This increase in quality is also in line with research done specifically with SCRUM methodology, where participants performed at higher levels based on the inclusion of SCRUM methodology (Magana et al., 2018).

The outcome for the RQ 2 aligns with both the theoretical framework, as well as the pre-existing literature. The quality of the product increased based on the inclusion of agile elements that were used during the development process. The theoretical perspective of SCRUM methodology and the IAA cycle provided a foundation to increase the quality of the courses based on their agile approach.

Limitations

Limitations for the Agile ADDIE Framework affected the credibility, and reliability, of the study. Time, site selection, and scope were all limitations that were identified during the research design. Although steps were taken to mitigate the

limitations of the study, it is essential to identify the limitations to ensure the research is understood within the context of those limitations.

The largest limitation on the mixed method action research study was the restriction of only using one course. Limiting the study to only one course also meant that the total number of participants was low. Ideally using several courses to collect the perception of participants, vary the stakeholders and program offices, and collect additional data related to the time the actual course took to develop would provide additional data to include in the analysis. The study was only able to follow one course throughout the development lifecycle, but future research can be done to include a wider selection of courses.

One of the most significant limitations was time. Given the length in which it takes to develop a course at the National Simulation Center, only one course was chosen to compare to the traditional ADDIE development model. This limited the number of courses that could be run, and the number of sites involved. Courses can take up to a year to develop and selecting more than one course could drastically increase the amount of time it would take to complete the research. Thus, the research design focused on following one course through the Agile ADDIE Framework while comparing it to a pre-existing course that had gone through the linear ADDIE development process.

Time also limited the research design, where the study had to end before the actual running of the pilot course. Following a course from assessment through the development phase an into the sustainment phase would have been ideal to see the full

spectrum of the Agile ADDIE Framework. Due to the timing limitations, the development cycle of the Agile ADDIE Framework remained the focus.

The limitation to the site, with only the National Simulation Center contributing to the research, makes it difficult to draw conclusions two organizations outside the VA, and makes it even more difficult to draw conclusions for organizations outside of government. Although there is a common understanding of what the ADDIE model entails, each instructional design department may have their own process. Having a more representative sample of sites in the future would provide significant benefits to the generalizability of the study.

Lessons Learned

It became clear as the development process was underway that some of the AWG members were uncomfortable with the speed in which the course was being developed, with one member actually identifying that the course was developed too quickly, and other processes such as scheduling a pilot had not caught up with the process. No immediate action was taken after the complaint had been received, as participants were just uncomfortable with how fast the process was moving. Although the participants were getting adjusted to the new pace of operations, an intervention of training would have had a big impact in preparing the participants. As a new methodology, it was clear that there should have been more education done on both the model as well as the agile principles. Throughout the process, it was evident that integration of agile principles throughout the research process was essential, and that the core understanding of day-to-day operations within an agile environment had not been fully understood by the participants. Although

the participants may not have understood the agile environment, they were able to evaluate their experiences throughout the process of working with the Agile ADDIE Framework during the development process.

During the development phase of the IAA cycle, it became clear that there were times in which the scope of the course had the potential to increase beyond the scope of the identified need. The flexible nature that helped move the process along so quickly, could also quickly become a hinderance if SMEs were allowed to veer too far off the path. Although flexibility ensured that the instructional designer could move the group back on to addressing the stated need, it is essential for a strong PM or instructional designer to take the lead when the course begins to grow past the stated need.

Another big takeaway from the research was the impact that holidays have on the sprint cycle. Throughout the development process Thanksgiving, Christmas, and New Year's all fell during critical junctures in the development process. Without strong SME involvement, these holidays could have substantially reduced the productivity of the development cycle. The impact it did have was mitigated due to the agile and SCRUM methodology that allowed for strong SME ownership of process.

The roles and responsibilities were also different from what is typical in a course development project. The PM did not own the project completely, but rather the instructional designer drove the development cycle. Ownership was passed from the PM to the curriculum developer due to the curriculum developer's understanding of the intervention, although this responsibility was not done intentionally. Providing additional training to the PMs may have mitigated this shift. Although the curriculum developer was

focused on the development of the curriculum, they were not focused on the project management aspects of the course developments as much as a PM would have been. An example of this would be the role of acquisition within the development process, where the curriculum developer did not have the same level of insight that the PM did.

Implications for Practice

With the identification that the Agile ADDIE Framework provided significant benefit to the development of a course at the National Simulation Center, the National Simulation Center will continue to use the Agile ADDIE Framework. Implementation at the National Simulation Center will have a profound impact on the problems of practice that are present within the center and ensure that courses are completed in a more effective and efficient manner. However, there is still much work to be done with instructional design shops within the United States government, and those still using the traditional ADDIE model.

The Department of Defense typically uses the ADDIE model to develop courses. With the development of large-scale systems, an overwhelmingly indoctrinated workforce, and a long history with the ADDIE model, the Agile ADDIE Framework presents a clear bridge. Often services within the Department of Defense cannot implement agile methodology or risk breaking entire software systems that are interdependent in the education process. The research presented within this study can be used in those systems, giving instructional designers an opportunity to develop within an agile environment.

Although the U.S. government is currently able to provide several levels of training throughout a very large enterprise, which has provided a unique understanding for the research. Outside of the United States government there are still individuals using the traditional ADDIE model. Any instructional design department could leverage the best practices that are found within the research. The incorporation of the IAA model, or the cyclical nature in which development occur and ensured SME centered interaction, are great best practices that can be leveraged throughout the operational environment.

Within the Veterans Administration there is a unique opportunity to further distribute the intervention across the enterprise. Through collaboration with other educational divisions, the Agile ADDIE Framework has the opportunity to increase the efficiency of the developed product, while maintaining or even improving the quality. The National Simulation Center has already implemented the Agile ADDIE Framework at the local level. Working with instructional designers, Associate Directors, and Division Directors, the research conducted in this study will be used to advocate for adjustments to the current policy for development. Additionally, further action research will be conducted at the National Simulation Center to further build upon the body of research surrounding the Agile ADDIE Framework.

Implications for Future Research

Although the Agile ADDIE Framework addresses agile elements within the instructional design field, there is still much work to be done in the field. Future research on agile elements would greatly inform decisions on what models and processes to use. Expanding the research on the Agile ADDIE Framework could explore the

generalizability of these study outside of government to include K -12 or higher education environments, and further research into the sustainment cycle.

This mixed method action research study identified the need for integrating agile methodology into linear processes to increase both effectiveness and efficiency. Although these results are substantial in answering a significant problem of practice, more research is needed in order to understand the full picture and implications in a larger contextual manner. The Agile ADDIE Framework being used with larger sample sizes, in different locations, in different contexts can provide valuable insight into the impact the framework has on instructional design departments, or educational institutions, using the traditional ADDIE model.

With the increase in frameworks and models that have been presented to the instructional design community, comprehensive research and comparison between different models and different contexts can provide instructional designers with further information on the value added within specific circumstances. Agile elements clearly provide a benefit over linear process development, but there is still a gap within the instructional design research on which models or frameworks to use under which certain circumstance. Research could also identify which frameworks and models provide the best quality products in the shortest amount of time.

Further research should also be conducted to evaluate the sustainability of the Agile ADDIE Framework. Although the development cycle was the focus throughout this study, research still needs to be conducted on how the rest of the framework functions within a traditionally linear organization. During the sustainment cycle, the Agile ADDIE

Framework presents new concepts that could substantially help traditionally linear instructional design organizations improve courseware at a more effective rate. Even with the SAM, after the products were delivered, there was no lifecycle management plan for the products. As we look at fashions with rapidly changing domains, there is a significant benefit to ensuring courseware reflects the requirements of the profession. Research into how the Agile ADDIE Framework integrates into this dynamic environment could provide significant lifecycle advantages and solve more challenges within the instructional design field.

Conclusion

As we look to create instructional products within industries with dynamic domains such as medicine and defense, the development of reactive and quick instructional design models is essential. The traditional ADDIE model leaves development steeped in blockades to progress disguised as phases. To overcome these obstacles the Agile ADDIE Framework was created and has been successful in overcoming the pitfalls of the linear waterfall ADDIE model. This mixed methods action research study focused on the time, flexibility, and resource constraints within the linear ADDIE model. The research also addressed the quality of product that the agile framework would deliver to ensure even though the outcome may be quicker or more flexible, the product would not be degraded.

The outcomes of the Agile ADDIE Framework were significant relative to the traditional ADDIE model. Developing a course using the Agile ADDIE Framework made it possible to develop product in a shorter amount of time than the typical National

Simulation Center course. Additionally, the results were more flexible and adaptable to external threats like the loss of a PM, and ultimately, produced a product that was of higher quality. Although acknowledging that the generalizable of the Agile ADDIE Framework results need additional research, the Agile ADDIE Framework and its elements have the potential to improve several key elements in instructional design.

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APPENDIX A

SEMI-STRUCTURED INTERVIEW QUESTIONS FOR PARTICIPANTS

Agile ADDIE Framework
Semi-structured Interview Questions for Participants

Introduction: Good morning/afternoon, my name is Jonathan Borgwing, and I am doctoral student at Arizona State University interested in exploring instructional design and the impact it has on developing instruction. During this interview you will be asked questions about the ADDIE process. There are no right or wrong answers, or desirable or undesirable answers. I would like you to feel comfortable saying what you really think and how you really feel. If it is okay with you, I will be tape-recording our conversation because it is difficult for me to write down everything while simultaneously carrying an attentive conversation with you. Everything you say will remain confidential.

Your responses will be confidential. You will use a unique identifier, one that is easy for you to remember, but one which no one else will know. The unique identifier will be the first three letters of your mother's name and the last four digits of your phone number.

What is the first three letters of your mother's name? _____
What is the last four digits of our phone number? _____

Pre-Intervention

General:

1. How do you feel the ADDIE model impacts the development of the project?
2. What are some of the struggles with the ADDIE course development process?
3. What are some of the benefits of the ADDIE course development process?
4. (RQ 1.1) When using the ADDIE model, how fast or slow do you feel the course is developed? Why?
5. (RQ 1.2) When using the ADDIE model, how flexible is the development process in reacting to the needs of the development effort? Why?
6. (RQ1.3) When using the ADDIE model, how does the development process handle resources constraints? Why?

Post-Interviews

Introduction: Thank you sitting down for another interview with us. As you know, my name is Jonathan Borgwing and I am doctoral student at Arizona State University interested in exploring instructional design and the impact it has on developing instruction. During this interview you will be asked questions about the Agile ADDIE Framework. There are no right or wrong answers, or desirable or undesirable answers. I would like you to feel comfortable saying what you really think and how you really feel. If it's okay with you, I will be tape- recording our conversation because it is difficult for me to write down everything while simultaneously carrying an attentive conversation with you. Everything you say will remain confidential.

Your responses will be confidential. You will use a unique identifier, one that is easy for you to remember, but one which no one else will know. The unique identifier will be the first three letters of your mother's name and the last four digits of your phone number.

What is the first three letters of your mother's name? _____
What is the last four digits of our phone number? _____

General

1. How do you feel the Agile ADDIE Framework impacted the development of the project?
2. What were some of the struggles with the course development process?
3. What were some of the highlights of the course development process?
4. (RQ 1.1) When using Agile ADDIE Framework, how was fast or slow do you feel the course was developed? Why?
5. (RQ 1.2) When using Agile ADDIE Framework, how flexible was the development process in reacting to the needs of the development effort?
6. (RQ1.3) When using the Agile ADDIE Framework, how did the development process handle resources constraints?

Intervention Specific

Program Assessment (Initial and Revisions)

7. What impacted do you feel the program assessment had on the project? Follow up/focus questions on impact on:
    a. Time
    b. Resource Constraints

c. Flexibility

Kickoff Meeting

8. What impact do you feel the kickoff meeting had on the project? Follow Up/Focus Questions on impact on:
    a. Time
    b. Resource Constraints
    c. Flexibility

(Iterate, Assess, Align) IAA cycle

9. What impact do you feel the IAA cycle had on the project? Follow Up/Focus Questions on impact on:
    a. Time
    b. Resource Constraints
    c. Flexibility

ID MGT Book

10. What impact do you feel the ID MGT Book had on the project? Follow Up/Focus Questions on impact on:
    a. Time
    b. Resource Constraints
    c. Flexibility

APPENDIX B

BIWEEKLY FOCUS GROUP QUESTIONS

Agile ADDIE Framework: Biweekly Focus Group Questions

Introduction: Good morning/afternoon, we will now start the focus group session part of the meeting. Over the next five to ten minutes we will discuss how you feel the current project is progressing. There are no right or wrong answers, or desirable or undesirable answers. I would like you to feel comfortable saying what you really think and how you really feel. If it's okay with you, I will be tape- recording our conversation because it is difficult for me to write down everything while simultaneously carrying an attentive conversation with you. Everything you say will remain confidential. You do not have to participate in this focus group, and like discussed previously, there are no consequences for not participating. It should last about 5 minutes and no more than 10 minutes.

1. How fast or slow do you feel the course is being developed? Why?
2. How flexible is the development process in reacting to the needs of the development effort? Why?
3. How does the development process handle resources constraints such as people and money? Why?

APPENDIX C

WEEKLY STRUCTURE REFLECTIONS

Agile ADDIE Framework Research

Semi-structured Journal Entries

1. How do you feel the development is regarding time?

2. How you think the development is progressing concerning resource constraints?

3. How flexible has the process been to the needs of the development?

4. How do you feel development is going in general?

APPENDIX D

MERLOT PEER REVIEW FORM

MERLOT

MERLOT Peer Review Report Form – V 17.6

Name of Learning Material (As it appears in MERLOT)	
MERLOT URL (From MERLOT Detail View)	
Learning Material URL: (Material site – from author) (If app, provide the URL from which it is downloaded)	
Your Name:	
Date Review Completed:	
Review Time required:	

Description

1. Overview: Describe subject matter, features and descriptions, uses and applications. This should be written in complete sentences (at least 3 to 4) and be a paragraph. NOTE: If it is an app, please indicate in a second paragraph whether it is free or what the cost is. Also mention the date you recorded the cost.	
2. Type of material: animation, assessment tool, assignment, case study, collection, development tool, drill and practice, e-portfolio, learning object repository, online course, open journal article, open textbook, presentation, reference material, simulation/game, social networking tool, quiz/test, tutorial, workshop and training material	
3. Technical requirements: What Browser you used; Software or plug-in, Java, HTML, Flash, etc. NOTE: If it is an app, type of device. i.e. iPad, Android phone.	
4. Identify Major Learning Goals: Goals for learner/user. (State from student's perspective) NOT purpose of site	
5. Recommended use(s): In class, homework, individual, team, lecture, etc.	
6. Target Population: Level, course or subject matter, other user groups.	
7. Prerequisite knowledge or skills needed: Course or subject matter, computer skills, other miscellaneous skills.	

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MERLOT

MERLOT Peer Review Report Form – V 17.6

Evaluation and Observations: **After reviewing the Learning Material, please indicate your agreement with the following statements by placing an "x" in the applicable column, where 5 = Excellent or strongly agree and 1 = Poor or Strongly Disagree.**

	1. Quality of Content – The Learning Material… *(Please use .25 increment rating scale)*	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	N/A
1	…is clear and concise						
2	…provides a complete demonstration of the concept						
3	…demonstrates a core concept grounded in the discipline						
4	…is current and relevant						
5	…is supported by appropriate research						
6	…is self-contained (can be used without requiring an assignment or context)						
7	…provides accurate information						
8	…is flexible (can be used in several situations)						
9	…includes an adequate amount of material						
10	…summarizes the concept well						
11	…integrates the concept well						
12	**Overall**, the quality of content is very high						
		(5)	(4.5)	(3.5)	(2.5)	(1.5)	0
	Please enter numeric value that summarizes your attitudes above. It needs to be in .25 increments						
Strengths: Describe the outstanding features of the quality of the learning material							
Concerns: Describe any problems in terms of quality. *NOTE: When a rating is < 5, concerns must be identified.*							

	2. Potential Effectiveness as a Teaching Tool/ This Learning Material… *(Please use .25 increment rating scale)*	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	N/A
1	…identifies learning objectives						
2	…identifies prerequisite knowledge						
3	…reinforces concepts progressively						
4	…builds on prior concepts						

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MERLOT

MERLOT Peer Review Report Form – V 17.6

5	...demonstrates relationships between concepts						
6	...is easy to integrate into curriculum assignments						
7	...is very efficient (could learn a lot in short time)						
8	...can be used to measure student learning outcomes						
9	**Overall**, learning material is a very effective teaching tool						
		(5)	(4.5)	(3.5)	(2.5)	(1.5)	0
	Please enter numeric value that summarizes your attitudes above. It needs to be in .25 increments						

Strengths: Identify the outstanding features of the possible effectiveness of the learning material for student learning.	
Concerns: Describe learning material in terms of student learning. *NOTE: When a rating is < 5, concerns must be identified.*	

	3. **Ease of Use- This Learning Material...** *(Please use .25 increment rating scale)*	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	N/A
1	...is easy to use						
2	...has very clear instructions						
3	...is engaging						
4	...is visually appealing						
5	...is interactive						
6	...is of high design quality						
7	...meets accessibility requirements, if able to assess						
8	...if an app, can be used on multiple types of mobile devices and platforms						
9	...if an app, runs effectively without the internet						
10	**Overall,** the usability of this learning material is very high						
		(5)	(4.5)	(3.5)	(2.5)	(1.5)	0
K	Please enter numeric value that summarizes your attitudes above. It needs to be in .25 increments						

Strengths: Indicate the outstanding features of the usability of the learning material	
Concerns: List problems in terms of usability. *NOTE: When a rating is < 5, concerns must be identified.*	

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MERLOT Peer Review Report Form – V 17.6

4. What is your overall numeric rating for this module? Review your 3 ratings above and determine your overall rating in .25 increments.	

Optional Information:

Other comments to be included in the review) If an app, respects privacy of others, meets PG rating standards, how frequently app is updated.	
Comments to Author Only (For authors view only. Any needed improvements or recommendations should be addressed here).	

Revised – 4/19

APPENDIX E

IRB APPROVAL

EXEMPTION GRANTED

Erin Rotheram-Fuller
Division of Educational Leadership and Innovation - Tempe
-
Erin.Rotheram-Fuller@asu.edu

Dear Erin Rotheram-Fuller:

On 5/3/2019 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	The Agile ADDIE Framework: An Agile Development Approach to the ADDIE Model
Investigator:	Erin Rotheram-Fuller
IRB ID:	STUDY00010094
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Working Group Participant Consent Form, Category: Consent Form; • AWG Recruitment letter/Consent, Category: Recruitment Materials; • Researcher Journal Format, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • IRB Protocol, Category: IRB Protocol; • Subject Matter Expert Reviewer Instructions, Category: Participant materials (specific directions for them); • Working Group Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Jonathan Borgwing CITI Certificate, Category: Non-ASU human subjects training (if taken within last 3 years to grandfather in); • Subject Matter Expert Reviewer Consent Form, Category: Consent Form;

	• Working Group Interview Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Subject Matter Expert Reviewer Recruitment Letter/Consent Form, Category: Recruitment Materials; • Working Group Focus Group Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 5/3/2019.

In conducting this protocol, you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Jonathan Borgwing
Jonathan Borgwing