Developing a Financial Readiness Mobile Personal Assistant for Learning

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ABSTRACT

While Service members and their families receive unique financial benefits as a result of their service, few are well educated in the best ways to manage their finances. Consequently, they may fall prey to predatory lending practices, high pressure sales pitches, and other financial pitfalls. Adding to the complexity of this problem is the fact that Service members' financial priorities change throughout their lives, both during service and after separation. 10 U.S. Code § 992 requires financial literacy training to be provided at specific points in Service members' careers, including significant life events, at promotion, and in concert with deployments. However, there is no guidance for what specific training content should be provided or when. Further, there is no solution to provide Service members complete access to financial literacy information. Due to the breadth of the financial domain, an effective solution must tailor content to the individual Service member, providing the right information in a timely way, and in an engaging and effective way. Although adaptive training is not a new concept, it is rarely designed to provide lifelong support to learners. Even less frequently are these solutions designed for mobile devices. In this paper, we describe research that designs and develops a mobile Personal Assistant for Learning to support Service member financial literacy. First, we describe the front-end analysis conducted to determine the scope of the domain and identification of learning objectives.

Second, we discuss the process to develop a framework mapping the content to specific points in a Service member's career to enable an adaptive learning experience. We also present research findings to support our approach. Our goal with this paper is to share the process used to design adaptive content to support lifelong learning and discuss lessons learned through our research.

ABOUT THE AUTHORS

Frank Hannigan is the Chief Operating Officer of Quantum Improvements Consulting, LLC. He has over 10 years of experience applying human factors and systems engineering principles and methods to the design of expert system displays and training curricula. Frank holds a M.S. in Human Factors & Systems from Embry-Riddle Aeronautical University and B.S. in Aviation Science from Saint Louis University. Frank has led projects on high-profile programs including the Navy's Zumwalt Class Destroyer (DDG-1000), the FAA's Next Gen Air Traffic Control System, has directly supported the DOE's Electric Grid Modernization efforts, and was tapped to execute a special assignment for the executive leadership at Sandia National Laboratories. Frank's research interests are rooted in human performance with respect to automation increases and technology enhancements, whether on the battlefield, in the cockpit, or in the classroom

Jennifer Murphy, PhD., is the CEO of Quantum Improvements Consulting, LLC. She has over 12 years of military selection and training research experience, with an emphasis on leveraging innovative technologies for improving training in a measurably effective way. Her current research focuses on developing assessments of Warfighter performance to enable adaptive training, predictive modeling, and improved training effectiveness. She holds a PhD in Cognitive and Experimental Psychology from the University of Georgia. Her research has been featured in in The New York Times, the Pentagon Channel, Soldier Magazine, and Signal Magazine.

Tarah Daly is a Senior Human Factors Engineer at Quantum Improvements Consulting, LLC. She holds a BS in Psychology and an MS in Modeling and Simulation from the University of Central Florida. Tarah has worked on government-funded projects including assessing training of vigilance tasks in video game-based environments, creating cognitive assessments to gauge skill decay, evaluating effectiveness of novel training technology to be utilized by the modern Warfighter, and researching psychophysiological paradigms for the investigation of a stress classifier utilizing mobile applications and technology. As an experienced human factors researcher, Tarah has designed and administered experimental protocol as well as conducted data analyses and has published work for DoD clients, academia, and industry.

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INTRODUCTION

While Service members and their families receive unique financial benefits as a result of their service, the systems and processes required to negotiate these benefits are complex and often difficult to use. In addition, many Service members enter military service without prior education in personal finance. As a result, Issues with individual Service member financial literacy affect the military at large. Recent changes in the military's retirement systems offer Service members more options when it comes to investing in their futures, but many are not prepared to make effective decisions in these areas. According to a 2015 report by the Military Compensation and Retirement Modernization Commission, improving financial literacy of Service members could save the Department of Defense up to $137M annually by reducing the number of service members separated from the military as a result of financial hardship.

To support financial literacy education, the Department of Defense (DoD) has implemented several initiatives. These include classroom training at military installations, individual Service member counseling, and websites. Despite these efforts, the 2015 Blue Star Families Annual Lifestyle Survey found that only 32% of Service members reported participating in financial literacy training offered through their command. Service members may not find the information easily accessible online due to security requirements such as Common Access Card (CAC) access. Finding the time to enroll in classroom training or visit a counselor may be challenging. According to our research, however, the largest hurdle to increasing financial literacy across the services is the perception that financial issues are not critically important until a problem already exists.

Additionally, military personnel's financial needs and goals change throughout their lives, both during their military service and after separation. To address these changing needs, 10 U.S. Code § 992 requires financial literacy training to be provided to Service members at multiple stages of their careers. Service members are required to have financial literacy training during initial entry training, at their first duty station, on the date of their promotion (up to E-5 or O3), when they vest in the Thrift Savings Plan, during leadership training, during pre- and post-deployment training, at major life events, and at separation. Tailoring training content to the individual Warfighter based on factors such as their current financial situation, goals, and career stage would encourage consistent financial planning and maximize training effectiveness.

To address these issues, the ADL Initiative and the Office of Force Education are developing an adaptive financial literacy training program to be accessible on mobile devices. This effort is consistent with ongoing Personal Assistant for Learning (PAL) initiatives (Schatz, Fautua, Stodd, & Reitz, 2015). PAL supports lifelong learning by providing contextually-relevant learning experiences across a variety of systems and platforms. PAL enables tailoring learning opportunities to the individual learner through ongoing assessments of performance data. If Service members are expected to continuously learn and adapt, the platforms from which they learn should allow this behavior to occur insitu, naturally, and seamlessly.

The impetus for this initiative stems from the 10 U.S. Code §992 requirement that military personnel receive financial literacy training throughout their lives and at multiple stages of their careers. This training is typically

provided in the context of formal military schoolhouse education, such as during Initial Entry Training. While this training provides a broad understanding of general financial knowledge, it is just one of many courses they take during that time. Further, access to this information is not readily accessible to Service members at the point-of-need, such as when making a major purchase or considering refinancing a loan. In addition to classroom instruction, financial counselors are available to Service members at their duty stations. However, by the time a Service member seeks out counseling, often a financial problem already exists. Dealing with financial matters can be daunting and embarrassing. While both classroom instruction and counseling services provide valuable support to Service members, the ability to supplement these resources with on-demand support fall short. They would benefit from personalized, timely financial literacy information to help them make better financial decisions.

CURRENT RESEARCH IN MOBILE LIFELONG LEARNING

Mobile Learning

Over the past decade, the Department of Defense has made a significant investment in research into best practices for using handheld mobile devices for training. Mobile learning is appealing for a variety of reasons. Providing information via mobile devices enables anytime, anyplace access to content. This increased access ultimately creates new learning opportunities outside of a formal learning environment; learners can access information on a subway, in their homes, or waiting in a doctor's office. Importantly, mobile platforms enable learning in context; information can be provided at the point of need, reducing the learner's need to remember information over long periods of time (Udell & Woodill, 2014). In addition, mobile platforms provide increased opportunities to repeat and reinforce information, which leads to better retention. Sensors and tools, such as cameras, microphones, brightness sensors, orientation sensors, accelerometers, GPS, altimeters, and compasses provide increased assessment capabilities (Udell, 2012).

To be maximally effective, mobile training must be designed with an understanding of the ergonomics and behaviors of use (Berking & Haag, 2015). Design for mobile learning must be portable, individual, unobtrusive, available, adaptable, persistent, useful, and intuitive (Sharples, 2000). Three guiding principles for mobile design are to provide content that is "just enough, just in time, and just for me" (Udell & Woodill, 2014). By "just enough," we refer to the use of microlearning approaches to provide short, focused pieces of content in context. "Just in time" content is provided not only when the learner perceives a need for information, but when the learner *should* need it. Taking this approach serves two benefits. First, the time between presentation of content and its application is reduced, increasing the potential for retention. Second, the learner is provided information about their own learning process, supporting metacognition. "Just for me" refers to the potential for personalization of learning. When combined with adaptive training approaches, mobile learning increases engagement, which ultimately leads to increased use over time.

Applying a mobile learning system does not automatically lead to performance improvements. One must consider a multitude of factors within the learning environment to effectively have an impact on the learner (individual differences of the learner, the content, the context, etc.). Mobile learning paradigms drawing from a wide array of differing theories to consider these factors. Learning theories associated with mobile learning include active experiential learning, inquiry-based learning, transactional distance theory, sense making (Rikala, 2013); context awareness learning, collaborative learning, lifelong learning, activity theory, and location-based learning (Keskin & Metcalf, 2011).

Literature suggests that mobile learning is effective because learners want learning opportunities to be just as mobile as they are and can benefit from mobile technology that allows for learning across space (physical distances), time (reviewing previously learned content, seeing a learning trajectory, etc.), and through the various interactions they have with differing pieces of technology. This type of framework lends itself to lifelong learning. Given the context in which adult learners learn – mostly outside of formal education, when they need to learn something, and through their own means (Fletcher, Tobias, & Wisher 2007; Ozuah, 2005; Sharples et al., 2005), mobile technologies can facilitate learning in an anywhere, anytime fashion. Additionally, many countries around the globe are pushing for broader, informal adult learning opportunities in response to social media's influence over people's opinions about important, salient, and current events (Walters & Watters, 2017).

Although instructional design elements are robust in the literature, relatively little empirically-based research addresses why mobile and blended learning technologies are more effective than traditional methods (Fautua & Schatz, 2015; Nordin, Embi, & Yunus, 2010). Some of the many questions include: are mobile learning technologies better able to provide temporally relevant learning episodes (e.g., just-in-time-training, scheduled or routine learning)?
Does mobile learning promote better habit formation or the internalization of differing motivational factors to learn and, what other cognitive-based elements could be at play? Does the ease of access of the technology itself or a product of the environment promote more effective learning (e.g., a behavioral or contextual issue)?

Lifelong Learning

Lifelong learning is a process of ongoing learning that takes place across an individual's life and typically refers to learning that takes place outside of formal education (Laal, Laal, & Aliramaei, 2014; Naismith, Lonsdale, Vavoula & Sharples, 2004; Sharples, 2000). Eraut (2000) describes this informal or 'non-formal' learning continuum as containing implicit learning (learning without intention or awareness), reactive learning (learning that has a component of intentionality but is unplanned), and deliberative learning (explicit learning with intention and awareness). Mobile technologies can support implicit, reactive, and deliberative learning because of their availability to the learner when the need arises (whether planned or spontaneous) and can track experiential learning; without the use of mobile technology, implicit and reactive learning occurrences may be lost. Mobile technology can also spark episodes of informal learning based on contextually-relevant information (time, place, proximity, etc.) to promote lifelong learning anywhere, anytime. Thus, lifelong learning can be initiated and supported by using mobile technologies.

Mobile devices (smartphones in particular) are portable, individual, unobtrusive, and available such that they are an integral accessory and part of an individuals' identity rather than just a mobile device (Naismith et al., 2004). However, more research needs to be done to show empirical support for these devices providing effective adaptable components, persistent and consistent learning content, and useful and effective learning episodes that drive lifelong learning in a meaningful way. How can mobile learning facilitate lifelong learning such that learning content is sustained, progress is continually tracked (e.g., experiential learning), and that contextually relevant materials are presented? What elements of mobile technology will afford engagement through the lifetime to achieve successful learning?

Adaptive Training

Adaptive training refers to the adaptation of training content and/or instructional methods to fit the individual needs of the learner based on various aspects of prior knowledge, abilities, performance, skills, and learning preferences (Landsberg, Astwood, Van Buskirk, Townsend & Steinhauser, 2012; Spain, Priest, & Murphy, 2012). There have been many instantiations of adaptive training methodologies, techniques, and procedures in the literature (see Landsberg, Van Buskirk, Astwood, Mercado, & Aakre, 2010 for a review).

Macro-adaptive strategies can be employed to determine placement within a training program, adjust content format, or appropriate level of control. These adaptations are often based on characteristics of the learner. Often, forward progress is determined by performance on prior learning modules such that evaluation of learning can take place before the learner has moved to the next module (adaptation takes place before instruction). Macro-adaptation interventions are not as flexible or individualized as other adaptive techniques. However, macro-adaption is relatively easy to instantiate into learning systems because each adaptive intervention is planned in advance and learners' 'routes' through available content are already mapped out (Spain et al. 2012). Aptitude Treatment Interaction (ATI) is an adaptive technique that matches instructional methods to learners' individual differences (Durlach & Ray, 2011). Research into the effectiveness of ATI approaches has been mixed (Landsberg et al., 2012). Micro-adaptation adapts content and instructional methodologies according to learners current or real-time performance. This form of adaptation requires a more involved, individualized approach and is therefore more difficult to instantiate. A compelling argument to use micro-adaptation is that it closely resembles the type of instruction a learner would receive with a one-on-one instructor (Landsberg et al., 2010). Another adaptation technique is the two-step approach, which is a combination of ATI and micro-adaptation methods. With this technique, learners can be placed into appropriate content based on their needs and then content is tailored at the

micro-level during learning or while on task (Durlach & Ray, 2011). While using either micro-adaptive or a two-step approach, user and usage data can be stored to enable later adaptations (e.g., a User Model [UM]; Martin & Carro, 2009).

When adaptive training is applied to mobile learning, learning opportunities can be produced to provide tailored and functionally-relevant learning based on myriad user-centered and hardware-specific parameters (e.g., context, learning preferences, goals, mobile device, etc.; Martín & Carro, 2009). Benefits of mobile learning can be paired with individualized components of adaptive training such that additional learning opportunities can be tailored to fit the needs of the learner. Furthermore, learners may be guided to salient and relevant content instead of merely having access to an abundant repository of knowledge (e.g., difference between having access to the internet and searching for something on your own vs. having access to the internet and being led to relevant materials). Martín and Carro (2009) found that utilizing an adaptive mobile learning environment increased students' motivation and that students found the environment useful for supporting their preferred learning styles. Recommendations provided to learners guided them to make optimal use of their time and facilitated collaboration and communication with peers such that, learning expanded to additional examples and increased discussion of theory. Research suggests motivation for collaboration and improved learning outcomes result from this approach (Gómez, Zervas, Sampson, & Fabregat, 2014; Magnisalis, Demetriadis, & Karakostas, 2011), however additional research is necessary. As there are many different mobile learning platforms and multiple adaptation methodologies, comparison of effectiveness is somewhat difficult. This and other research questions must be answered to mature the field of adaptive mobile learning as well as showcase how this can be leveraged to support lifelong learning such that the system can always be adapting to the needs of the learner throughout their lives.

DEVELOPING A FINANCIAL READINESS MOBILE LEARNING APPLICATION

In this section, we describe the approach used to design the Financial Readiness Personal Assistant for Learning (FRPAL). Designing an application to support Service members' financial literacy presents unique challenges. With the design of any training system, a determination of the end-user requirements through a front-end analysis is one of the first steps. In this case, our potential end-users span all branches of the military, including Active Duty and Reserve components, as well as their family members. Because financial readiness is a topic relevant to all Service members throughout their careers, this application needs to be continuously relevant. This requires a plan for long-term implementation of new features and capabilities to maintain engagement and use. In addition, the domain of financial literacy content is broad, and delivering a substantial amount of content through a mobile platform without overwhelming the learner is a challenge. To address these, and other issues, our team applied the principles and best practices associated with mobile design, lifelong learning, and adaptive training.

In addition to providing an effective financial readiness training platform, FR-PAL may be utilized to answer questions posed in the theoretical literature about utility and effectiveness of such systems. We can explore the cognitive and behavioral-based elements associated with motivation and engagement, improved performance, learning, and retention. The following sections will describe the methods used to design FR-PAL and the components that will make this system useful for a foundation and platform to answer these more pressing empirical research questions.

Methods

Front End Analysis

The activities undertaken to develop the end-user requirements can take many forms including a review of documentation, surveys and questionnaires, observations, one-on-one interviews of stakeholders (end-users, subject matter experts, and customers), focus groups, competitive analyses, or gap and performance analyses, among others. In this instance, several of the methods listed above were conducted in determining the end-user requirements for the mobile-based training under development.

Reviewing of Guiding Documentation

Guiding documentation available for review include 10 U.S. Code 992 and Section 661 of House Resolution 1735, the National Defense Authorization Act for Fiscal Year 2016. These documents were reviewed and analyzed as part

of the front-end analysis to identify top level requirements to be flowed down throughout the development of the application. Each document outlines events in the life of a service member at which training must be provided and to some extent, the type of training to be provided. These events include at initial training; upon arrival at first duty station; upon arrival at subsequent duty station for those individuals E-3 and below or O-3 and below; upon promotion for individuals E-5 or below or O-4 or below; when an individual vests in the Thrift Savings Plan (TSP); when an individual becomes eligible for continuation pay; during major life events including marriage, divorce, birth of first child, or disabling sickness; during leadership training; during pre- and post-deployment training; at transition points including from regular component to reserve, separation from service, or retirement; and during regularly recurring training provided at military installations (H.R. 1735 NDAA, 2016). Each of these events form the foundation by which the type of content being provided to the Service member is developed. For instance, individuals receiving initial training may need more basic budgeting and credit & debt information whereas an older individual retiring or otherwise separating from the Service may require information on benefits available, or no longer available to him/her as a result of the separation and how those benefits may impact their financial picture. The type of training to be provided, though not solely by a mobile application, include "life insurance, casualty insurance, other insurance, investments in securities or financial instruments, banking, credit, loans, deferred payment plans, mortgages, health insurance, budget management, Thrift Savings Plan (TSP), retirement lump sum payments (including rollover options and tax consequences), and Survivor Benefit Plan (SBP)" (10 U.S. Code § 992 - Financial literacy training: financial services). The documentation begins to provide the breadth of the scope of information that can be provided and to whom it should be provided. In this case financial readiness training should be made available to not only the Service member, but the Service member's family members as well. The trigger points require that financial readiness training should occur for Service members throughout their military careers and beyond, indicating the requirements for lifelong learning and an adaptive, and by necessity, engaging nature to the application. Building an understanding of the guiding documentation in this way allows for greater focus in follow-on analyses, particularly with stakeholder interviews.

Competitive Analysis

The competitive analysis consists of conducting a review of similar tools in the market including mobile applications and websites, developed by Government or Military entities along with those developed by for-profit companies and non-profits alike. Our team identified over 40 existing financial literacy websites, tools, or other sources of information for review. Each tool was reviewed for several factors including content, military or Service member focus, and user interactions. Human factors experts, subject-matter experts, and individuals with Instructional Systems Design experience conducted the review to determine, in each of the previously listed categories, positive and negative design aspects, and the extent to which, and how, similar content or interactions could be incorporated into the financial readiness mobile application. This type of review helps designers capitalize on content and interactions that can help maintain engagement throughout years of use of the application. This type of analysis also aids researchers in focusing their interview protocols for follow-on discussions with stakeholders.

Stakeholder Discussions

Stakeholder discussions can involve many diverse types of people with varying points of view and can be conducted in a variety of ways. Traditionally, stakeholders include a customer, subject-matter experts, and end-users. In this case, there are multiple customers along with subject-matter experts and end-users spanning each of the military services, each with their own perspectives and requirements. Thus far, ongoing discussions continue to occur with both customers ensuring design and development meet the customers' requirements. Recently meetings and a focus group took place with representatives from each of the Services, responsible for policy and curriculum development, many of which had previous roles as financial advisors. These activities shed light on the types of financial issues most frequently seen of Service members, from their perspective, and associated with the trigger points discussed earlier. The life event of 'upon arrival at first duty station' has the most financial issues associated with it and also the broadest range of issues including such items as basic budgeting and credit & debt information, but also fraud protection, family planning, long-term savings, and the BRS. In contrast, financial readiness training required as a part of recurring training had the fewest items. This life event had items such as 'reinforce training' and 'finance overview' as the types of training content that should be provided during these times. Analyzing not only the types of information associated with each life event but also the priority assigned to each financial issue by the Service representatives allows application designers to prioritize content within the application based on the trigger points and potentially upon other demographics such as age, service, active v. reserve v. retired, etc. Finally, focused interviews or focus groups with the Services' Personal Financial Counselors (PFCs) and actual end-users (Service members, spouses, veterans) from a representative sample across the Services are in the process of being scheduled.

Additional qualitative data collected and analyzed as a result of these activities will further allow designers and developers to create a financial readiness mobile application that meets the needs of its users.

Design

Content Development

The first step in developing content for the FR-PAL application was the identification of learning objectives. This was accomplished through a review of existing content and tools available on Government and commercial websites and discussions with our team's subject matter expert. As a result of these activities, designers developed a content ontology that is used to organize and establish relationships between all of the content within the application. Our team initially conceptualized the content we identified as "money in" (e.g., benefits and income), "money out" (e.g., debt and spending), and "money to keep" (e.g., savings and investments). This ontology continues to evolve based on our engagement with stakeholders.

Taking an adaptive approach to content presentation within FR-PAL is necessary due to the substantial amount of financial literacy content available. If presented in a sequential manner like typical long-form training, a Service member would be challenged to find the information most relevant to their personal situation, and would not likely continue use of the application. To enable adaptation within the application, opportunities for assessment were designed. Our goal was to enable multiple levels of adaptation. Specifically, we aim to adapt content based on the user's current status with regard to key life events, their current financial needs, and their existing knowledge of content areas. To enable macro-adaptation, a brief series of questions are answered during the initial login. These questions help prioritize the content within FR-PAL and guide the user toward the most relevant information to them.

Once inside a training module (e.g., "debt") a short pre-assessment evaluates the user's existing knowledge of the domain and prioritizes content within the module accordingly. At the end of a module, a short post-test provides checks on learning as well as enables evaluations of training effectiveness.

One of our team's challenges was developing engaging content. Despite its importance, financial literacy is not typically a topic most individuals enjoy learning about, and unless end users are engaged, the material will not be retained. To support engagement, we developed concepts for a variety of mini-games and interactive elements within the application. These mini-games provide opportunities for learning as well as assessment, and encourage continued use. An example of this approach is depicted in Figure 1. In this interactive element, an end user "drives" down a road and passes billboards advertising payday loans, debt elimination, and other common financial pitfalls targeted at Service members. The user clicks on each sign to reveal more information about each pitfall, and how it relates to them. The goal is to increase overall financial awareness about the sorts of problems Service members specifically have.

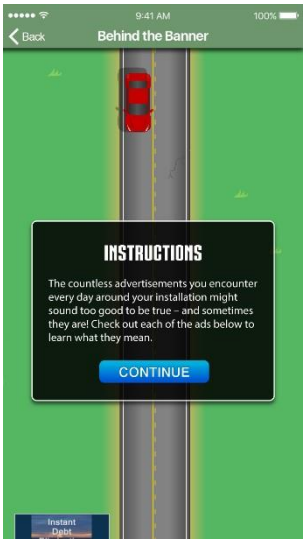

Figure 1: Interactive Elements within FR-PAL

Mobile Interface Design

To develop an application that meets the needs of a broad range of end users, supports lifelong learning, and provides just-in-time financial literacy information, best practices in mobile design were implemented. Typical e-learning is designed to be completed all at once, with no need to revisit the content after the lesson is completed. However, our goal for FR-PAL was to provide a tool that Service members could come back to whenever they needed support. One of the challenges our team faced was developing an interface that enables users to access the content they need the most, when they need it. To support this, an easy to navigate menu screen was designed that provides access to content by category, and shortcuts to key features such as a search capability and glossary.

As a result of the front-end analysis activities, researchers, designers, and developers created an initial prototype indicative of what the final product may look and function like. To do this, the team used an iterative design process that engaged the client and stakeholders via stepped, actionable design deliverables. UI and UX designers worked with the development team to understand functional and technical requirements and distilled these into focused business requirements. Designers then used the business requirements to help drive content and UI design. All screens, states and dialogs were created as living documents and as the requirements evolved, these changes were flowed back into the application's design documentation.

Designers also engaged in the creative aspects of design as well. Tools like mood boards, wireframes and iconographic design were used to help achieve success in these areas. Once a general look and feel for the overall project or effort was decided on, the detailed design work of mockups, hi-fidelity prototypes and user acceptance testing began. This process fits in-line with industry accepted practices. Throughout this design process, our approach centers on advocating for the user and to provide value for the user in a "two-clicks, ten seconds" fashion.

Assessment of Design

Usability

Important to the design of the application is an iterative testing process. Our team conducted the first of three scheduled usability tests, on a low-fidelity prototype to explore navigation schema and collect objective and subjective feedback on the early design of the application. The application mockups were generated in InVision and presented on a Galaxy S7 phone with an Android operating system. Eight local participants were recruited to participate in the study, three of which had prior military experience. Participants met with a researcher and note-taker on site at the study location. Participants completed an informed consent form along with a brief demographic survey. Participants then completed four test scenarios, 'thinking aloud,' while the researcher and note-taker observed and noted their behavior and interaction with the application. Upon completion of the test scenarios, participants completed several subjective questionnaires.

Test scenarios were identified and developed based on the limited content of the of the prototype. Test scenarios included:

1. Create an account and navigate to the main dashboard
2. Access and complete the Behind the Banner game
3. Access and interact with the Credit Score infographic
4. Access the settings menu.

To evaluate the navigation scheme of the application, objective data were collected as participants interacted with the application in the form of errors or deviations from the end goal of the scenario. This early in the design, subjective data is likely to provide more meaningful feedback than the objective data. Hence, several subjective measures (Satisfaction Questionnaire (SQ), Subjective Usability Questionnaire (SUQ), and System Usability Scale (SUS)) were used in addition to the think aloud protocol. Participants also responded verbally to a subjective questionnaire.

The objective navigation data collected provided useful information for a variety of facets of the application. While all participants attempted and completed the tasks, completion of some tasks was not without additional prompting or guidance by the researcher. Some navigation issues were a result of information not being located somewhere that met the participant's expectations. Other navigation issues had root causes in lower level design elements such as design patterns, colors, salience, and interaction locations. Through targeted questioning during and after each scenario, the team was able to determine why the participants' expectations were not met and how to better meet them through improved design.

Results of the questionnaires showed outcomes that were aligned with the team's expectations. While not all responses were positive, they shed light on the shortcomings of the prototype and provide the design team with guidance on improving the design. The Satisfactions Questionnaire is a five-item questionnaire that assesses the user's perceived satisfaction with the overall application. The SQ showed an average rating of 66.11% which indicates user's satisfaction with the application was rather low however, being that the participants were working with low-fidelity mockups, this outcome is not surprising. The Subjective Usability Questionnaire is comprised of

16 items divided into four categories: 1) screen, 2) terminology and system information, 3) learning, and 4) system capabilities. Each item is evaluated separately and a composite score from all rated items provides and overall score of the application. The average participant rating was 76.10% which is encouraging considering the limited functionality of the low fidelity prototype. With respect to the screen, participants rated characters and icons easy to read, but the organization and screen sequence during navigation was at times, unclear. When rating the terminology and system information, participants agreed the terminology was consistent with the required tasks, but that they were not kept informed about what was occurring as they were progressing through each of the tasks. In the Learning category, participants rated the application as easy to use and easy to explore new features, thought it was easy to remember names and use of commands, and felt the tasks could be performed in a straight-forward manner. Finally, when rating system capabilities, participants thought they could easily correct their mistakes while interacting with the application. The results of the System Usability Scale also showed acceptance of the current state of the application with room for improvement. The average score of the SUS was a 75.6 with low skewness (.15) meaning the results are approximately symmetric.

An analysis of the findings, both objective and subjective, included a cross-walk of the data collected so a full understanding of the data and the implications on the design could be understood. Design recommendations were then documented and provided to the team for inclusion in subsequent development of the application. There were eight categories in which design recommendations were sorted including, navigation, content, interaction, iconography, buttonology, status, authentication, and aesthetics. In all, 13 recommendations for design changes were made based on this initial usability test.

CONCLUSION

According to a 2015 report by the Military Compensation and Retirement Modernization Commission, poor Service member financial literacy costs the Department of Defense up to $137M annually due to Service member separation because of financial hardships. As a result, 10 U.S. Code § 992 requires financial literacy training to be provided to Service members at distinct times throughout their military career. Because an individual's finances do not exist in a vacuum, particularly when a Service member is in a relationship, military spouses are included as well. While training is provided in classroom settings and via professional financial counselors, there are a multitude of reasons why these modes of training may not be as effective as would be desired. Additionally, the financial information imparted during these classes or sessions with financial counselors may not be readily available to the Service member when needed. As a supplement to existing training mechanism, FR-PAL is being developed to be that point-of-need tool that Service members, veterans, and military spouses can use to help them make positive financial decisions. To that end, FRPAL will provide adaptive content, meeting the needs of a broad user base, is being designed for mobile, so as to be accessible anywhere, anytime, and is being developed using microlearning and gamification design concepts to promote life-long usage and engagement.

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