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14. ABSTRACT
This report described the summative testing performed under contract to develop a mobile micro-content financial readiness training application for Service members and their families. Formative testing during development of the application preceded the herein described in-person summative testing with target end-users representing members of all Services components. Further details about the full project can be found in the final report titled "Financial Readiness Personal Assistant for Learning – Final Report".

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QUANTUM IMPROVEMENTS CONSULTING

Financial Readiness Personal Assistant for Learning

W911QY-16-C-0163

Summative Usability Test Results Report

7/13/2018

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Executive Summary

The Financial Readiness-Personal Assistant for Learning (FR-PAL), Sen\$e, is a native mobile application designed to support service members and their families with financial readiness information using micro-learning, gamification, and other motivational techniques to cultivate life-long learning. The usability and effectiveness of Sen\$e was evaluated using active military service members. Eight current service members completed usability testing to determine the extent to which user expectations of the application structure, content, interfaces, and functionality were met. This usability evaluation identified benefits of the interface and overall application as well as potential design concerns and areas for enhancement. Benefits included the clean, intuitive, and simple design and display of information. There were some concerns with respect to navigation and content organization within the system. Twenty-seven service members completed the effectiveness evaluation where knowledge gained from the application was assessed. Participant feedback was collected through semi-structured interviews. Results from this summative evaluation are presented for usability, user experience, user satisfaction, and application effectiveness. Recommendations for future design and development of the Sen\$e application are provided with the intent of improving the user experience and usability of the application.



1. 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. To support financial literacy education, the DoD has implemented several initiatives. These include classroom training at military installations, individual service member counseling, and access to resource websites. Despite these efforts, it has been found that only a small percentage of service members are reporting having access to these resources. This may be due to a myriad of factors related to time and access restrictions. To address this gap, the ADL Initiative and Office of Financial Readiness have developed a Personal Assistant for Learning to provide military personnel financial literacy information anytime, anyplace, on mobile devices. In support to this initiative, Quantum Improvements Consulting (QIC) in partnership with Float, and meLearning Solutions, developed a Financial Readiness Personal Assistant for Learning (FR-PAL) called Sen\$e. Sen\$e supports service member financial literacy and preparedness through engaging “bite-sized,” personally relevant, multimedia content. To encourage continued use, Sen\$e features motivational elements such as push notifications, gamification, and visual progress indicators. In addition to educational content, validated financial tools and resources are incorporated into this user-centered application.

A summative evaluation was conducted to gauge usability, user experience, user satisfaction, and application effectiveness. In the final stage of the Sen\$e design cycle, the summative evaluation provides the final feedback for the overall application and diagnostically evaluates specific areas within the application as well. The general perspective across all the surveys was that the application was useful and rated ‘excellent’ in terms of user-friendliness, therefore, meeting the application goal. By and large, participants said that the application was easy to use, useful, and contained important and relevant information. When participants mentioned wanting something different, they indicated a desire for more detailed content and more tools. The main usability issues related to navigation and specifically to content categorization and organizational structure. Participants also did not understand what the term “Touchpoint” meant, as this was cause for several of the navigational errors encountered.

“I wasn’t expecting that to be so cool.”

– Navy participant

The results of the effectiveness evaluation suggest that Sen\$e is an effective learning tool. User opinions garnered through semi-structured interviews revealed that participants found the content to be straightforward and useful. They appreciated the option to explore content in more detail through overlays, accessing content outside of the application, and exploring infographics and other interactions to reveal additional content. Participants specifically liked the integration of an accordion design to help manage large chunks of information by intuitively revealing and concealing information. In general, the navigation and interactions were intuitive and met the participant’s expectations when tapping on hyperlinks, exploring different types of menus, and scrolling through the content. While the overall impression of the Sen\$e application was very positive, participant actions indicated room for improvement in how content is organized and clarity of

“This application is a lot easier than Google because it’s military specific, and there usually is a difference between military and civilian circumstances.”

– Air Force participant



nomenclature. The remainder of this report details these findings and presents suggestions for enhancements categorized across six themes (navigation, content, interaction, buttonology, status, aesthetics).

2. Usability

Methodology

Participants

Eight participants from across four branches of the military (U.S. Navy, U.S. Air Force, U.S. Marine Corps, and U.S. Army) stationed at Joint Base Pearl Harbor-Hickam, Marine Corps Base Hawaii, and Schofield Barracks, respectively ($M_{age} = 30.13$ years; $SD = 5.62$; Men = 8, Women = 0) were recruited to participate in this study. All participants are currently serving in the military ($M = 8.69$ years of service; $SD = 6.81$). Six Enlisted (E5 - E9) and two Officers O1- O3 from a variety of career fields participated. The qualifiers for participation were to be at least 18 years of age, current or former service member, and to be a naïve user to the Sen\$e application. Participants were informed that their participation was voluntary, and they could end the evaluation at any time. Participants self-reported their smartphone use (Table 1).

Table 1. Smartphone Usage Survey Responses – Usability Participants

Survey Item	Average Response
What type of phone do you use?	4 Android; 3 iOS; 1 both Android and iOS devices
How long have you been using a smartphone?	7-10 years
How often do you use your smartphone?	3 hours a day
How often do you use your smartphone to:	
Check email	30 minutes a day
Play mobile games	45 minutes a day
Browse the internet	1 hour a day
Use financial applications	30 minutes a day
Learn new information	45 minutes a day

Procedure

Participants met with a study facilitator and note-taker at their respective military installation. Participants first read and signed the informed consent form and were introduced to the goals of the study. Next, participants completed a demographics questionnaire. Participants were then invited to take five minutes to freely explore the Sen\$e application. The study facilitator set a timer for the five-minute duration and handed the participants their choice of phone. Participants used the type of phone they indicated they were most comfortable using for the duration of the study (iPhone 7 Plus, iPhone 6s, Samsung Galaxy S7, or Google Pixel). A fully-functional prototype version of the application was presented on one of the four phones.

After the five-minute exploration, participants performed four test scenarios while “thinking aloud.” The think aloud protocol requires the participant to say, out loud, what they are doing while they are doing it. Meanwhile, the facilitator directly observed the participants’ actions and strategically asked questions throughout their interaction with the application. The note-taker observed the participants’ interactions with the application, took notes, and asked any clarifying questions regarding any responses or interactions. From time to time, the facilitator asked participants questions or, in some cases, provided assistance toward correct task goals and navigational paths. Following the test scenarios, participants completed the Satisfaction Questionnaire (SQ;



Lewis, 1995), Subjective Usability Questionnaire (SUQ; Lewis, 1995), and the System Usability Scale (SUS; Brooke, 1996). The SQ is an overall system measure derived from the Computer System Usability Questionnaire (CSUQ; Lewis, 1995) and is a semantic differential five-item questionnaire that assesses the participant's perceived satisfaction with the overall system. Ratings are indicated using a 9-point Likert scale. The SUQ is also derived from the CSUQ and is a semantic differential questionnaire, but it is comprised of 16 items broken up into four main categories: 1) screen, 2) terminology and system information, 3) learning, and 4) system capabilities. Ratings are indicated using a 9-point Likert scale. The SUS is a 10-item questionnaire focused on perceived usability of the system and requires them to rate their subjective responses using a 5-point Likert scale. These measures can be found in Appendix B. At the end of the evaluation, participants were asked to respond verbally to several debrief questions regarding their experience with the application. Participants were then thanked for their time and dismissed.

Test Scenarios

Test scenarios were identified by the project team based on available functionality of the application and reflected tasks which included a variety of in-application interactions and financial content. The test scenarios were as follows:

Scenario 1: "Locate and access information about categorizing expenses, then return to the Sen\$e dashboard."

Scenario 2: "As part of your Initial Entry Training (IET), you know you have training requirements pertaining to financial readiness. To get ahead, you decide to use Sen\$e to review information about Banking Services and Fees. Locate the Banking Services and Fees section and access the Banking Services and Fees challenge."

Scenario 3: "You are interested in learning about the financial impact a child would make on your family. You are expecting your first baby. Use Sen\$e to learn about budgeting tips for your baby Pre-Delivery. Review the information about Pre-Delivery, then complete the challenge."

Scenario 4: "You've been thinking about the ways interest can affect your savings. You want to compare compound and simple interest on your future earnings. Say you deposit \$500 with 5% compound interest vs simple interest after 20 years. Find out the dollar amount difference."

Data Collected

Participants' workflow, or the path taken to accomplish the tasks in each scenario, was observed and noted. The research team noted critical errors (i.e., deviations from the scenario goal), such as navigating to wrong areas within the application. Participants may or may not have been aware that deviations from the scenario goal occurred or that a goal was not met. Their descriptions of the path they were taking was collected using a "think aloud" protocol.

Participants' reactions to the application were collected through semi-structured interviews and subjective user experience and usability questionnaires. As each participant worked toward the goal of each test scenario, they were asked to discuss what they were doing while they were interacting with the application. Throughout, and after each test scenario concluded, the facilitator asked clarifying questions regarding interaction, intent, and participant expectations of their experience using the application. After all test scenarios concluded, participants completed the SQ, SUQ, and SUS. Finally, participants verbally discussed their likes, dislikes, and suggestions about Sen\$e when prompted by the facilitator during the evaluation debrief. Interview responses are presented at the end of the report, combined with the data from the individuals who participated in the effectiveness testing.



Test Scenario Analysis

Test Scenario #1 – Locate Categorizing Expenses from the Dashboard

“Locate and access information about categorizing expenses, then return to the Sen\$e dashboard.”

Optimal Path Procedure

From the Sen\$e dashboard > scroll to locate the “General” section > scroll to locate the “Expenses/Spending” button > tap the “Expenses/Spending” button > locate and access the “Categorizing Expenses” button > return to Sen\$e dashboard by tapping “Dashboard” > tapping “Back.”

Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	3	5	0
Percent of participants	37.5%	62.5%	0%

Areas of Success

Categorization

Almost all participants noted that they expected content like “Expenses and Spending” to be contained in a “General” category. While they may have required prompting to get to this content from the dashboard, “Expenses and Spending” was categorized in a way that most participants expected.

Areas for Enhancement

Issue: Navigation

Five participants had difficulty locating the “Categorizing Expenses” content from the dashboard. After navigating items on the dashboard, these participants felt that “Categorizing Expenses” would be located in a general area like “Financial Awareness” because that seemed like a broad category that would have contained information on expenses. One participant even tapped on the “DTI Ratio” button, saying that you need to first know your expenses in order to know your DTI. The button for “Expenses/Spending” is not visible on the default view of the dashboard. Four participants were able to locate the main area “Expenses/Spending” with explorational navigation on the dashboard but two participants initially failed to scroll to the right to view more options. Upon seeing the broad category “Financial Awareness,” they assumed that content pertaining to “Categorizing Expenses” would be located there, in the “General” section. However, these participants did not need prompting to find their way to “Categorizing Expenses.” They realized their own navigational error, saw that the content in either “Financial Awareness” or “DTI Ratio” was not what they were looking for, returned to the dashboard, and eventually found the “Expenses/Spending” button, allowing them access to the “Categorizing Expenses” content. Only one participant needed explicit prompting to exit “Financial Awareness” to go back to the dashboard and was then able to locate the “Expenses/Spending” button.

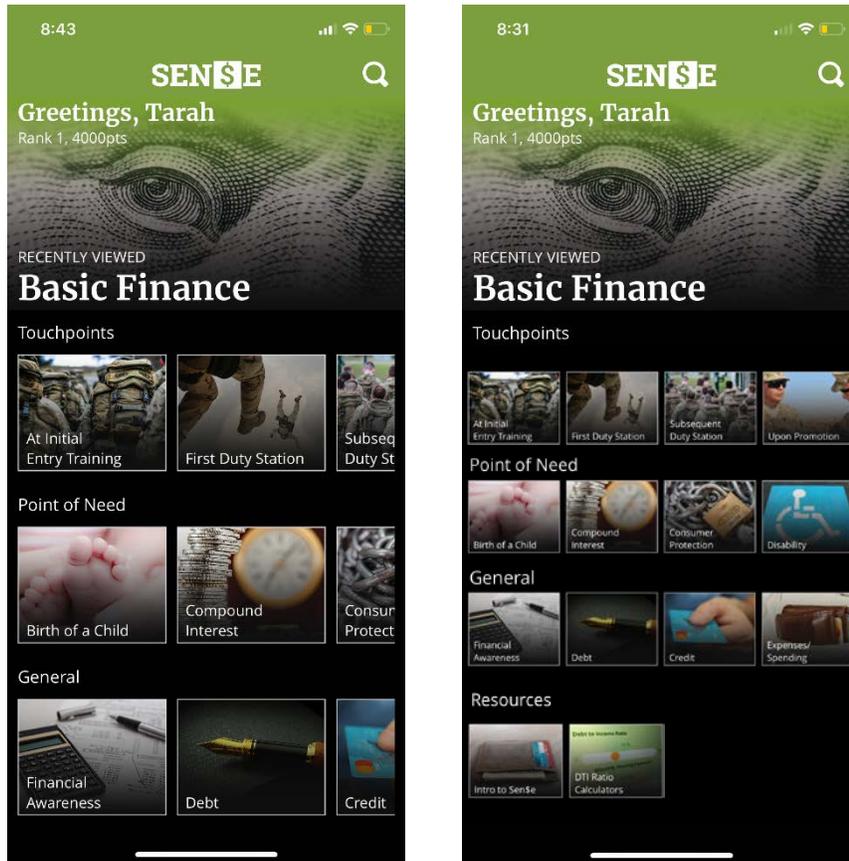
Recommendation: Navigation

One possible option is to show more content on a single screen on the dashboard (see Figure 1b for a conceptual example). By reducing the size of the menu options, horizontal scrolling can be reduced or eliminated, resulting in less navigational interactions and increased saliency of the extent or breadth of the content available to the user. Four participants noted that increasing the size of the category titles/headers (i.e. “Touchpoints,” “Point of Need,” “General,” etc.) and decreasing the size of the images/icons would help them to better navigate and locate the information on this screen. Additionally, of the four participants who required additional time to navigate the dashboard, three stated that they did not like the horizontal (left/right) scrolling on the dashboard.



Another possible option to eliminate horizontal scrolling, is to turn headers of content categories into accordion menus. Content buttons can expand and contract to display or hide the menu options contained within.

Figures 1a & 1b. Current dashboard layout; optional layout - smaller icons, more options on screen



Areas of Note

There are no areas of note for this test scenario.

Test Scenario #2a – Locate and Access Banking Services and Fees Content

“As part of your Initial Entry Training (IET), you know you have training requirements pertaining to financial readiness. To get ahead, you decide to use Sen\$e to review information about Banking Services and Fees. Locate the Banking Services and Fees section and access the Banking Services and Fees challenge.”

Optimal Path Procedure

From the Sen\$e dashboard > scroll to locate the “Touchpoints” section > scroll to locate the “At Initial Entry Training” button > tap on “At Initial Entry Training” button > tap on “Basic Finance” button > tap on “Banking Services and Fees” button > scroll down and tap on “Let’s Get Started” button.



Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	5	3	0
Percent of participants	62.5%	37.5%	0%

Areas of Success

Buttonology

Almost all participants noted that the interactions on the pages within “Banking Services and Fees” met their expectations. The accordion menu and associated “+” symbol indicated to participants that it was something they could interact with and potentially tap to get more information.

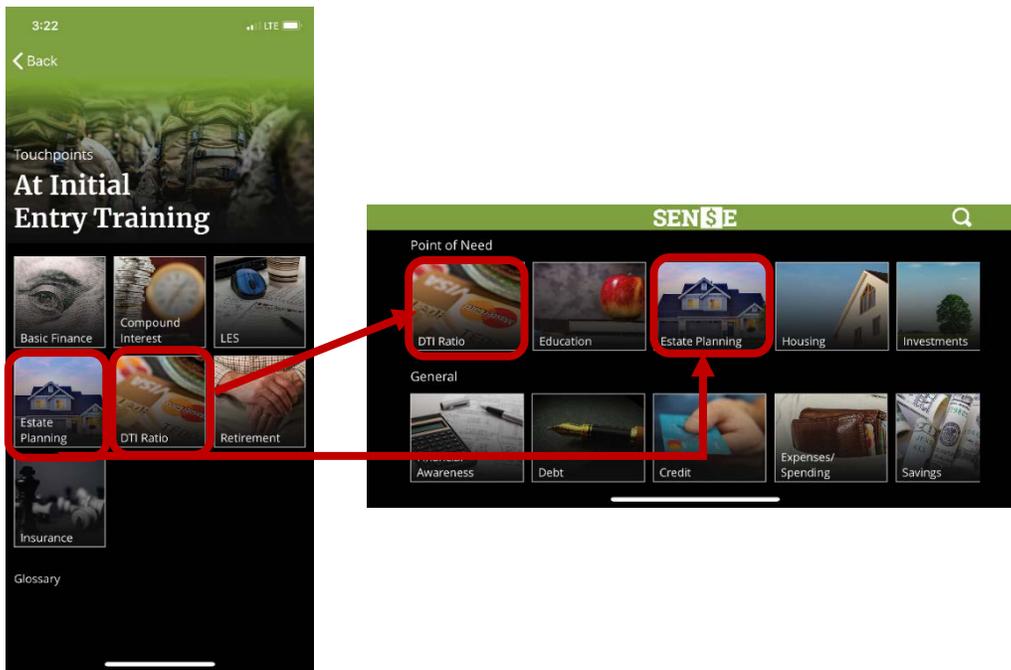
Areas for Enhancement

Issue 1: Navigation – Locating Information

Three participants had difficulty locating the “Banking Services and Fees” content. While the scenario provided information about the location of the content (within Initial Entry Training), the participants attempted to find information on “Banking Services and Fees” within the “General” section of the dashboard. These participants needed prompting in order to help them navigate back to “Initial Entry Training” in the “Touchpoints” section of the dashboard. Additionally, even after prompting by the facilitator, two participants noted that they still were expecting a stand-alone section within “Initial Entry Training” that was called “Banking Services and Fees” and were not expecting to have to access a section called “Basic Finance.” One of them indicated that is why they hesitated tapping on the “Basic Finance” button to navigate further.

Recommendation 1: Navigation – Locating Information

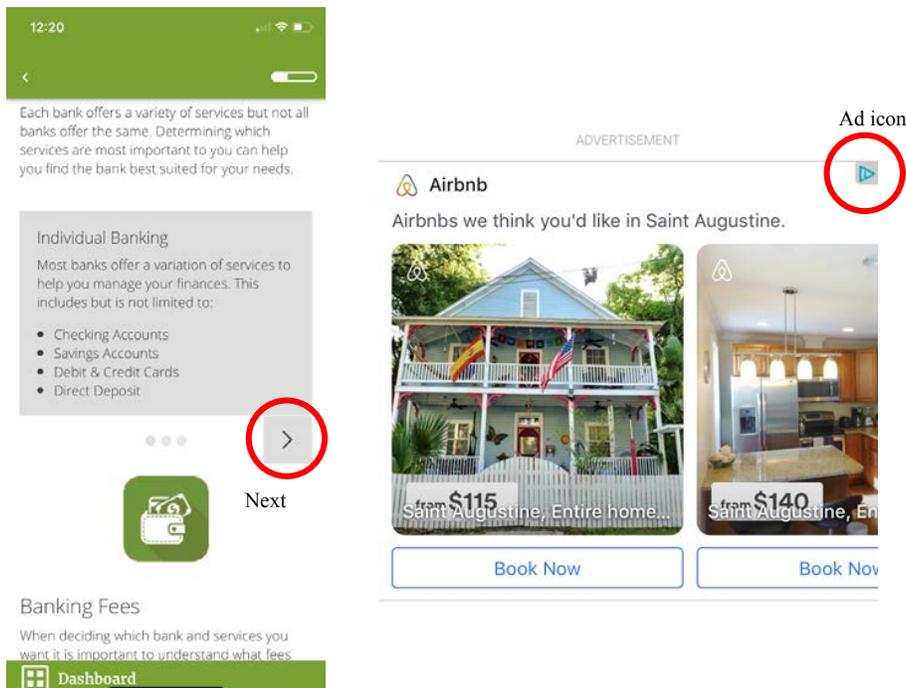
While most participants were able to locate and access the content easily, scenario instructions played a large role in helping navigate participants to the correct location. Within the dashboard, many content buttons are replicated throughout sections, mainly found within “Touchpoints” and then replicated either within the “Point of Need” or “General” area. To make the content within “Basic Finance” more accessible, it may benefit the user to have this content button replicated both within the “Touchpoints” but also within the “General” section (Figures 2a and 2b).



Figures 2a & 2b. Dashboard options replicated within IET and Point of Need

Issue 2: Navigation – Arrow Function

Four participants made specific comments regarding the arrow button within the flipbook or slideshow interaction. All of these participants tried to use a swipe interaction to navigate to the additional pages indicated by the three dots (Figure 3a). The participants were expecting a swipe feature and did not expect the application to limit their interaction to just the arrow button. Two participants indicated that they did not realize the arrow buttons were associated with the text information in the flipbook area, and one of these participants even mentioned that the arrow button looked like it might be from an ad (Figure 3b).



Figures 3a & 3b. Interaction arrow in Sen\$e; AdChoices info button on an advertisement

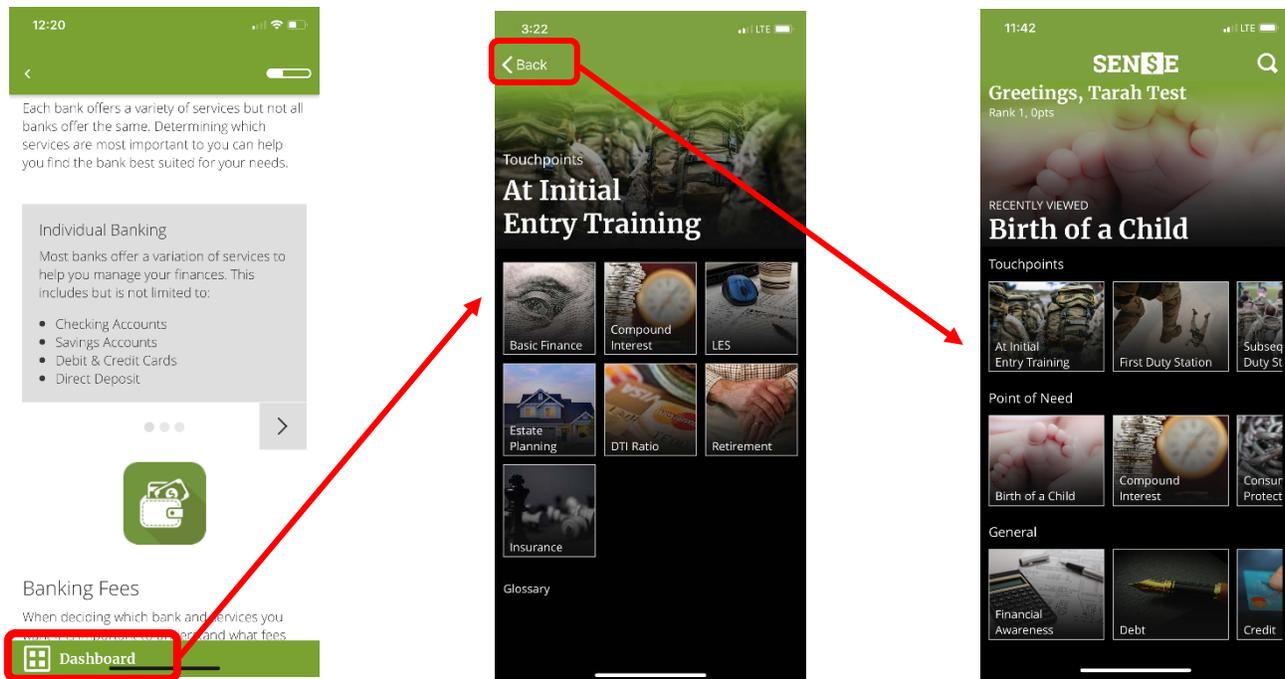


Recommendation 2: Navigation – Arrow Function

To reduce this error, it is recommended to eliminate the arrow icon and apply the swipe gesture to interact with the content. If arrow icons are preferred, it is recommended to make the association between the content and the navigational buttons more salient. Currently, the arrow looks to be *outside* the area of content contained within the flipbook. If all the associated assets (text information, additional page indicators, navigational arrows, and graphics) were contained in the same shaded region or grouped in by a box, then these assets could be associated more closely with one another. Similarly, moving the arrow buttons slightly up into the grey shaded region could create a stronger association between the text, navigational arrows, and additional pages as well.

Issue 3: Navigation – Dashboard

Three participants mentioned that the dashboard button did not return them to the main dashboard, but instead brought them back out to the “Initial Entry Training” options. They noted that they expected the navigation for a button labeled “Dashboard” to bring them out to the main application dashboard. They also indicated that the additional step to tap on the “Dashboard” button and then the back button (the “<,” arrow) at the top of the screen to bring them out to the main dashboard was cumbersome and not expected. Participants indicated that they expected the "Dashboard" button to return them to the main dashboard (Figure 4c), not Initial Entry Training (Figure 4b).



Figures 4a, 4b, & 4c. Current user flow to return to the main dashboard

Recommendation 3: Navigation – Dashboard

To reduce the frustration participants felt during their interaction with the “Dashboard” button, it is recommended to add a “Home” button that will navigate participants to the home screen (main dashboard) from anywhere within the application (each screen should then contain a “Home” button). Additionally, it is recommended to include a *sub-dashboard* navigation functionality (e.g., button) that will bring users out to the touchpoint options (see Figure 4b for an example of this sub-dashboard screen). The use of a “Home” button,



or the reference to a “Home Screen,” is common terminology in mobile applications and should be considered here, in addition to a specialized navigation button for the sub-dashboard area.

Areas of Note

Divided Opinions: Case Studies

Four participants reported mixed opinions regarding the scenario or case study located at the bottom of the “Banking Services and Fees” area. One participant reported really liking the case study, mentioning that it was useful for helping to relate to their own situation, even if it did not align exactly. Another made the comparison to their mandatory military training in which scenarios are used, however, those military training scenarios are interactive and the participant would have liked to see an interactive element in this scenario as well. Two participants found the scenarios cumbersome, not useful, or something that users would just click through without reading just to get to the next section.

“We have mandatory online training, they have interactive pictures like this, so I expected the case study to be similar to that...I wanted to actually make a decision regarding Lindsey and John, rather than just be told.”
– Army participant

Recommendation: Case Studies

Case studies were considered an area of note because several participants mentioned them within the context of their interactions with the application. However, participant comments were both positive and negative. Due to the mixed opinions and comments regarding the case studies, it is recommended that further end-user testing be done to determine the extent to which changes should be made to the case studies, if any. This type of media presentation and subsequent interaction will need additional testing should similar items be implemented in future iterations.

Test Scenario #2b – Access the Banking Services and Fees Challenge

“As part of your Initial Entry Training (IET), you know you have training requirements pertaining to financial readiness. To get ahead, you decide to use Sen\$e to review information about Banking Services and Fees. Locate the Banking Services and Fees section and access the Banking Services and Fees challenge.”

Optimal Path Procedure

Scroll down through content and access all information in flipbook and accordion menus (tap arrows to access all pages of the flipbook interaction and tap “+” button to access all information in the accordion menu) > tap the “Banking Services & Fees Challenge” button (from grey, should be highlighted orange now).

Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	2	5	1
Percent of participants	25%	65.5%	12.5%



Areas of Success

Useful Information

Two participants pointed out that the “Banking Services and Fees” information located within “Initial Entry Training” was helpful and relevant, and that the information located there would be incredibly useful for new/junior members, stating it is likely a time when financial issues would occur. Notably, an E9 in the Air Force indicated that the information in “Banking Services and Fees” was “really good.”

Areas for Enhancement

Issue: Accessing the Challenge

All but two participants required significant prompting from the researcher in order to activate and access the “Banking Services and Fees” challenge. Of the five participants that completed the task with guidance, only two of them realized that the challenge must have been linked to interacting with the content. During clarification questioning, these two participants mentioned the challenge seemed similar to current online training that they are required to do. Only with this background knowledge did they assume that unlocking the challenge involved either interacting with the accordion menu items or with the scenario/vignette (but not both, which required prompting from the researcher). One participant failed to interact with all content even after significant prompting from the researcher and was moved on to the next scenario after acknowledging verbally that all content must be opened and viewed in order to activate and unlock the challenge.

Recommendation: Accessing the Challenge

One option to reduce this error is to provide users with guidance or instructions regarding the activation of the challenge. Placing the challenge activation in context within the content setting can take many forms (e.g., a pop-up notification, a set of instructions at the beginning of the text, reactive feedback associated with either scrolling to or tapping on a grey challenge button). Additionally, considerations should be made to include alerts pinpointing specific areas of content that require interaction in order to activate challenge buttons.

Another option is to remove the requirement that all content be viewed before the challenge activates. In this way, users can leisurely and unobtrusively explore and navigate the content at their discretion. A few participants suggested that if they did not have to view all the content and decided to take the challenge, it could lead them to discover areas of content that they were unfamiliar with, very similar to a self-check on learning.

Areas of Note

Area of Note 1: Progress Bar

Of the two participants who completed the task with no prompting, only one mentioned they realized that the progress bar, in the top right-hand corner, updated when the participant interacted with content items on the screen (i.e. either scrolling down, viewing additional pages of the flipbook interaction or tapping the accordion menu drop downs). In this way, the participant assumed that they would have to interact and view all content in order to progress to or activate the challenge mentioned in the test scenario.

Recommendation 1: Progress Bar

Participants may have failed to recognize the progress bar located in the top right-hand corner of the screen (Figure 5). This indicator not only acts as a completeness meter and alerts the user to progress within the content, but it could also be used as a notification for challenge activation (see the Feedback Error section). Making this progress bar more salient or including other more informative features may render the progress bar useful to users. Some participants recommended titling the progress bar area, displaying percentages on the progress bar, or changing the colors of the progress bar to make the appearance of progress through the



content more apparent. Increasing the size of the progress bar may also help the saliency of the users' progress through the content and, in turn, informing users of how close they are to completing the section.



CASH FLOW



What is Cash Flow?

Cash flow refers to the amount of cash going into and out of your account. It helps determine how much income you have left over after all your expenses have been paid.

Understanding your monthly cash flow will help you evaluate your current financial status, so you know where you stand financially as you prepare for future investments.



Figure 5. Progress bar

Area of Note 2: Terminology

The term “Challenge” may equate to “Games.” Three participants noted that when they heard the term “challenge” in the scenario instructions, they immediately thought that it meant there may be an associated game. During the participants’ five-minute free exploration, it is possible that they noticed the “Games” section on the dashboard, so they may have had knowledge that games existed in the application. One participant did exit the content and attempt to navigate to the “Games” section in order to comply with scenario instructions.

Recommendation 2: Terminology

It is recommended that the term “challenge” denoting the knowledge assessments at the end of the content remain unchanged. However, during the development of future iterations of the application, it is recommended to conduct additional formative testing to determine terminology that is better aligned with the user’s expectations regarding post-assessments.



Test Scenario #3a – Locate and Access Pre-Delivery Content

“You are interested in learning about the financial impact a child would make on your family. You are expecting your first baby. Use Sen\$e to learn about budgeting tips for your baby Pre-Delivery. Review the information about Pre-Delivery then complete the challenge.”

Optimal Path Procedure

From the Sen\$e dashboard > scroll to locate the “Point of Need” section > scroll to locate the “Birth of a Child” button > tap on “Birth of a Child” button > tap on “Birth of a Child” button again > tap on “Pre-Delivery” button > scroll down and tap on “Let’s Get Started” button.

Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	4	4	0
Percent of participants	50%	50%	0%

Areas of Success

Content

Upon viewing all the content located in this section, four participants commented that the information within the “Pre-Delivery” area was informative, useful, and relevant to service members.

“I would be curious to know what I would learn if I had more time to explore the application.”
– Air Force participant

Areas for Enhancement

Issue: Navigation – Locating Information

In all the cases where participants needed facilitator guidance to locate the content, participants had selected the first button, “Planning for a Child” on the “Birth of a Child” table of contents page and not the “Pre-Delivery” button (Figure 6). Many of the participants indicated that in an area like this, they would have wanted to view the content chronologically and that planning for a child seemed like it would come before the pregnancy or birth. However, it was noted that the titles “Planning for a Child” and “Pre-Delivery” sounded like they would contain similar information and that it was not too clear that distinguishing content would be located in those two sections.

Recommendation: Navigation – Locating Information

The main point of contention for this navigational error was that participants viewed the two content areas as containing similar information, based on content title alone. If they were going to be exploring the application on their own, they would have wanted to view this information in a chronological path. Additionally, some participants mentioned that the test scenario wording “...learning about the financial impact...” and “learn about budgeting tips for your baby...” led them to expect that type of financial information in the “Planning for a Child” area because they attributed the term *planning* to mean *financial planning*. It could be that a simple title change alluding to distinct and disparate information is needed to help users find relevant content and to reduce errors locating that content.

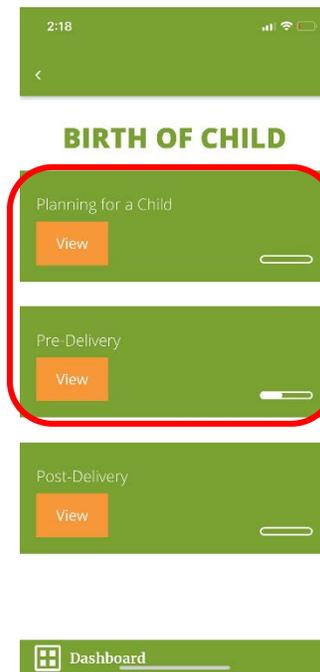


Figure 6. Table of Contents within "Birth of a Child"

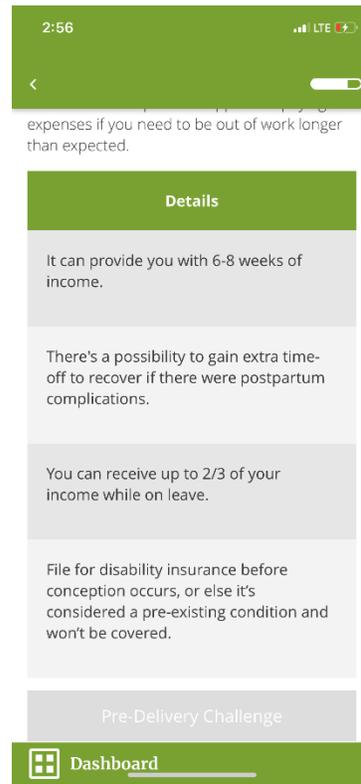
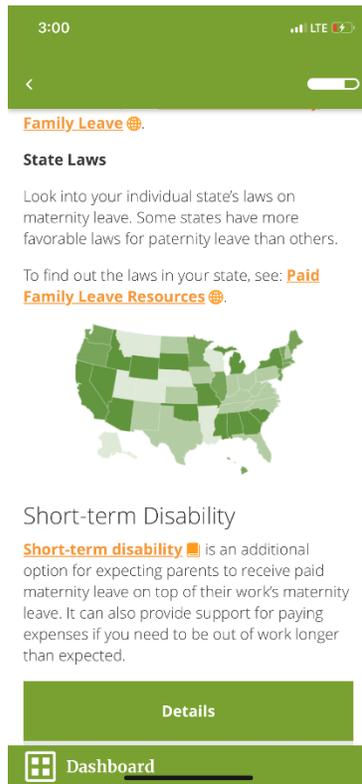
Areas of Note

Apparent Buttonology

Four participants tapped on the header of the table ("Details") located in the "Short-term Disability" area on the page (Figure 7b). Upon observing this interaction, the facilitator prompted participants to explain what they were intending to do or what they had expected to happen. In these cases, participants mentioned that they believed the area to be an interactive button and tapping on it would have expanded to show more information. Depending where the user is on the page, the header for the table does appear to be a button for more details (Figure 7a). If the user scrolls further down the page, it may be clearer that the green bar labeled "Details" is a header for the table. It was also noted that participants thought that the information may have expanded or collapsed from the green title bar, much like an accordion menu.

Recommendation: Apparent Buttonology

It is recommended that the table header be modified to reduce the similarities between it and other interactive buttons on the same screen. The color, size, and shape of this title bar looks very similar to the challenge button located at the bottom of the page. Changing the header to match similar text headers with a subsequent bulleted list instead of a table-like look or button for an accordion list will reduce similarities to interactive buttons on the screen.



Figures 7a & 7b. "Details" header, view from two different page locations

Test Scenario #3b – Complete the Pre-Delivery Challenge

“You are interested in learning about the financial impact a child would make on your family. You are expecting your first baby. Use Sen\$e to learn about budgeting tips for your baby Pre-Delivery. Review the information about Pre-Delivery then complete the challenge.”

Optimal Path Procedure

Scroll down through content and access all information in the accordion menus (tap “+” button to access all information in the accordion menu) > tap the “Pre-Delivery Challenge” button (from grey, should be highlighted orange now) > tap an answer choice > tap the orange “Submit” button > tap the “x” on the feedback pop-up to progress to next question > (repeat these steps until all questions have been answered).

Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	4	4	0
Percent of participants	50%	50%	0%



Areas of Success

Challenge Feedback

Seven participants found that the feedback they received for a correct or incorrect response on the challenge was helpful, useful, and met their expectations for an interactive question-and-answer interaction. Some participants noted that they liked the layout of the challenge questions, how the feedback acted as a pop-up, and that the feedback also contained the question so that they did not have to remember what the question was in order to make sense of the feedback being received. Others noted that the feedback was straightforward and provided them with information on what they need to go back to reread in the content.

Areas for Enhancement

Issue: Accessing the Challenge

Four participants required significant prompting from the facilitator to activate and access the “Pre-Delivery” challenge. It was not clear that all content must be viewed prior to activating the challenge. Even after participants completed Test Scenario #2, in which case they needed to access the challenge in the same way (view all pieces of content on the page – accordion menu items and flipbook content), they still did not know why the “Pre-Delivery Challenge” button had not activated.

Recommendation: Accessing the Challenge

To reduce this error, users need to receive guidance or instructions regarding the activation of the challenge. Placing the challenge activation in context within the content setting can take many forms (e.g., a pop-up notification, a set of instructions at the beginning of the text, reactive feedback associated with either scrolling to or tapping on a grey challenge button). Additionally, considerations should be made to include alerts pinpointing specific areas of content that require interaction in order to activate challenge buttons.

Alternatively, the requirement to view all content prior to accessing a challenge could be deleted, in which case this error and associated confusion would no longer exist.

Areas of Note

There are no areas of note for this test scenario.

Test Scenario #4a – Locate and Access Compound vs. Simple Interest Content

“You’ve been thinking about the ways interest can affect your savings. You want to compare compound and simple interest on your future earnings. Say you deposit \$500 with 5% compound interest vs simple interest after 20 years. Find out the dollar amount difference.”

Optimal Path Procedure

From the Sen\$e dashboard > scroll to locate the “Point of Need” section > scroll to locate the “Compound Interest” button > tap the “Compound Interest” button > tap the “Compound Interest” button again > tap on “Compound vs. Simple Interest” button > scroll down and tap on “Let’s Get Started” button.



Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	3	3	2 (time constraints) ¹
Percent of participants	37.5%	37.5%	25%

Areas of Success

Relevant Information

All six participants noted that seeing information on compound interest was a good thing as it is a term that comes up a lot in financial training or in financial-related conversations but that many people do not know what it really is or how it relates to them. Two participants noted the link between compound interest and the retirement or Thrift Savings Plan (TSP) content sections.

Areas for Enhancement

Issue: Navigation – Locating Information

Three participants needed prompting in order to locate the “Compound vs. Simple Interest” area for this scenario. Two of the three participants felt that information on compound interest would be located in the “General” section and therefore continued to explore the main dashboard. They thought that compound interest might be located in “Financial Awareness” but also potentially in the “TSP” section of the application.

Recommendation: Navigation – Locating Information

The “Compound Interest” button is currently located in the “Point of Need” section on the main dashboard. There were several participants that noted they did not consider information about compound interest necessarily a *point of need* but rather something they would find in the “General” section. Since the “Compound Interest” button was not in an area where most participants expected it to be, this could have led to their navigational error in locating it. It is recommended to recategorize this information into the “General” section on the main dashboard (Figure 8). Additionally, as mentioned in a previous recommendation, eliminating the horizontal scroll feature and including more dashboard options on the screen to increase saliency of content buttons may also reduce navigation-related errors.

¹ The two participants who did not complete this test scenario were prompted by the facilitator to move on to the next task, after Test Scenario #3, due to time constraints. This is not reflective of their ability to complete the scenario.

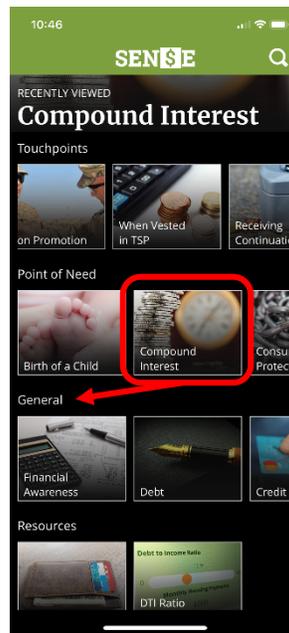


Figure 8. "Compound Interest" located within "Point of Need," recommended to recategorize to "General"

Areas of Note

There are no areas of note for this test scenario.

Test Scenario #4b - Calculate difference between Compound and Simple Interest

“You’ve been thinking about the ways interest can affect your savings. You want to compare compound and simple interest on your future earnings. Say you deposit \$500 with 5% compound interest vs simple interest after 20 years. Find out the dollar amount difference.”

Optimal Path Procedure

Scroll down through content and tap the “How much do you want to invest” text area > enter “500” > scroll down and tap on “How much interest is your investment earning?” text area > enter “5” > scroll down to the “Compare the two” area > use slider bar and slide to the right until “After 20 years” is displayed.

Performance Summary

	Completed	Completed with guidance	Did not complete
Number of participants	6	0	2 (time constraints) ²
Percent of participants	75%	0%	25%

² The two participants who did not complete this test scenario were prompted by the facilitator to move on to the next task, after Test Scenario #3, due to time constraints. This is not reflective of their ability to complete the scenario.



Areas of Success

Useful Interactive Content

All six participants reported that the interactions on this screen and within the “Compound vs. Simple Interest” met their expectations and were easy to use. One participant was “pleasantly surprised” when they noticed that a “Let’s Try It Out” interactive section appeared amidst the text explanations about interest.

Areas for Enhancement

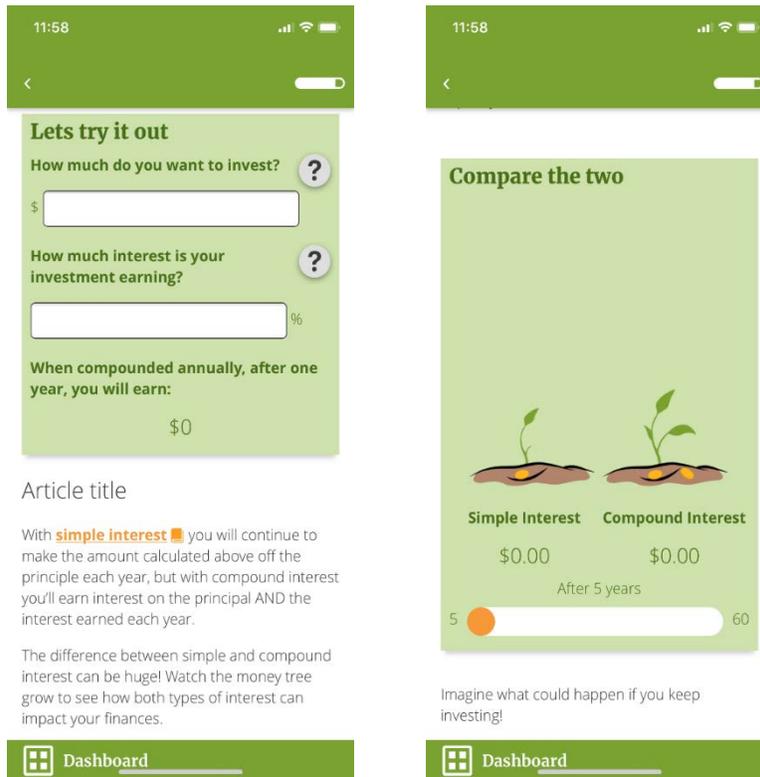
All participants completed this task without prompting or guidance from the facilitator and reported that the content section was intuitive and easy to use. There are no recommendations related to usability issues at this time.

Areas of Note

While there are no apparent usability issues for this test scenario (all participants who attempted this scenario were able to complete the task with no prompting from the facilitator), there are a few notable interactions and comments from participants.

Area of Note 1: Related Information

Three participants reported being confused by the two interactive green boxes located within the “Compound vs. Simple Interest” area (Figures 9a & 9b). It was not clear to participants that the figures they entered within the first green box, “Let’s try it out,” related to the second green box, “Compare the two.” One participant even decided to return back to the first box, reentered new figures, and then checked that the “Compare the two” contained updated simple and compound interest figures. This participant noted that the “Let’s try it out” clearly looked like it was interactive and allowed the user to input numbers, whereas the “Compare the two” area seemed *fixed* and did not really allow for user input. The participant went on to note that the text between the two areas made a distinct *barrier* and that they assumed the green-boxed interactive areas were separate concepts. However, some participants noted that they quite liked the simple interaction right within the content, for a hands-on example, without the need to go back to the “Compound Interest Calculator.”



Figures 9a & 9b. Compound vs. Simple Interest interactive areas

Recommendation 1: Related Information

One way to create a relationship between the two interactive areas located in this section is to place the text that separates them before the interaction, moving the interactions closer together in physical space. One participant mentioned exactly that.

Area of Note 2: Graphic Lacking Purpose

Another area of note within the “Compound vs. Simple Interest” is the graphical representation of money earned for both simple and compound interest, the *money tree* analogy. While participants mentioned that the interactions were simple, mostly met their expectations, and generally considered the area useful, some participants suggested including more informative elements. Instead of the graphic and highly stylized plant, participants wanted to see something graphical, so they could easily spot the differences between simple and compound interest, especially for projected earnings. Additionally, while participants thought that displaying the different dollar amount interest figures was useful, one participant noted that it might be beneficial to also include the calculated difference. The numbers produced for this specific task made it rather simple for participants to compare amounts earned (Figure 10a), but for more complex calculations, it may be difficult to perform the mental math required to spot specific dollar amount differences (Figures 10b & 10c for an example). One can quickly ascertain that the dollar amount difference (the requirement for this task) is \$326.65. However, when entering in different figures, say an initial investment of \$690 with a 6% interest, after 20 years, it becomes more difficult to perform mental math.



Figures 10a, 10b, & 10c. Example dollar amount difference between simple and compound interest

Recommendation 2: Graphic Lacking Purpose

It was suggested that with all the unused space on the screen, a veridical representation of simple vs. compound interest be used, rather than a stylized money tree graphic. A bar graph or line graph was mentioned, along with the dollar amount differences automatically calculated for the user, to be presented in this area.

Data Analysis

The following figures contain survey responses collected via paper-based questionnaires (SQ, SUQ, and SUS) after participants' interaction with the application. Data are presented across all participants, by military branch, and by age range. Age ranges were selected to capture equal numbers in each range. Data is presented in bar charts. All bar charts contain standard error bars. Where standard error bars are not visible, the standard error is zero.

Satisfaction Questionnaire

The Satisfaction Questionnaire (SQ) assesses perceived satisfaction with the overall application. The SQ items seek to identify the participant's reaction to the application relating to perceived usefulness, ease, satisfaction, flexibility, and trustworthiness. Ratings are indicated using 9-point Likert items. Each item is evaluated separately and a composite score from all rated items provides an overall satisfaction score of the application (Figure 11). To measure perceived satisfaction with the overall application, a total composite score across all items is converted to a percentage. The average rating was 86.67% (SD = 10.95%). Participants perceived the



application as useful ($M = 7.88, SD = 1.25$), easy ($M = 7.75, SD = 0.89$), satisfactory ($M = 7.00, SD = 2.33$), flexible ($M = 7.50, SD = 1.20$), and trustworthy ($M = 8.88, SD = 0.35$).

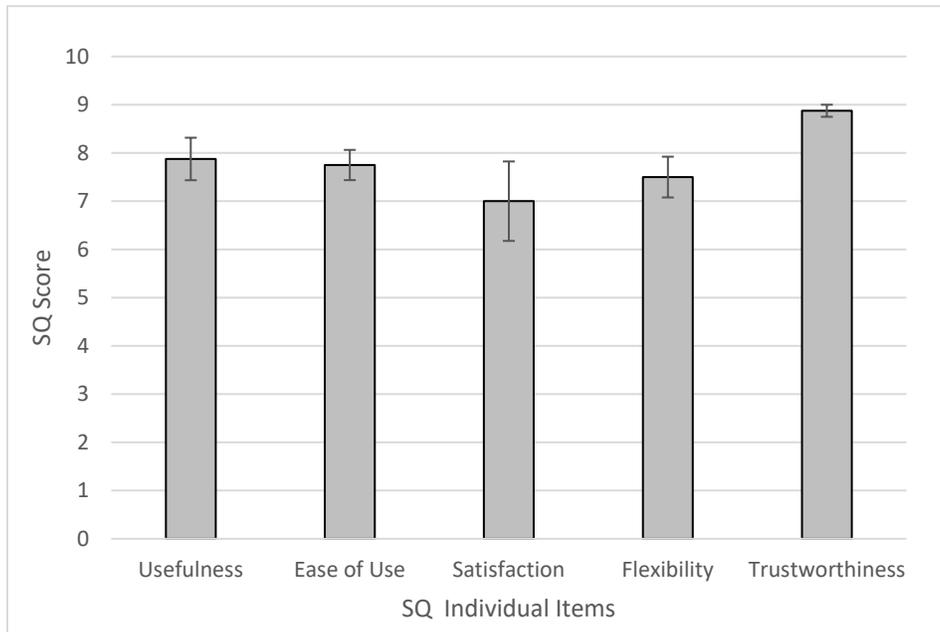


Figure 11. Average ratings across all participants for each item of the SQ



Figure 12. Average ratings across military branch for each item of the SQ

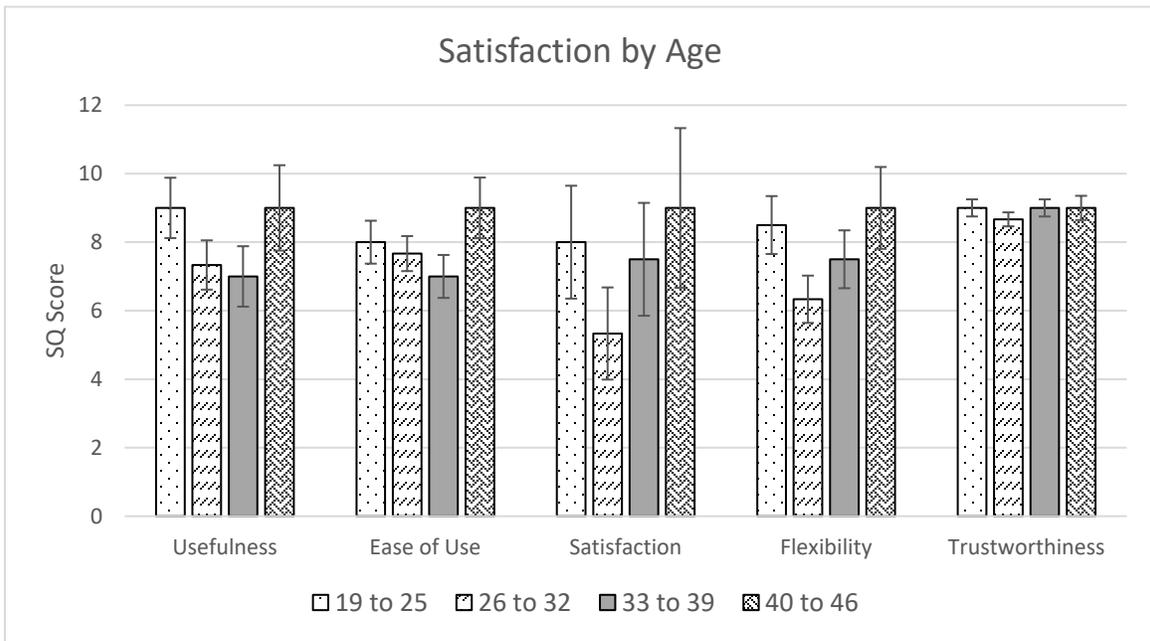


Figure 13. Average ratings across age ranges for each item of the SQ

Subjective Usability Questionnaire

The SUQ is a semantic differential questionnaire comprised of 16 items broken up into four main categories: 1) screen, 2) terminology and system information, 3) learning, and 4) system capabilities. Ratings are indicated using 9-point Likert items. Each item is evaluated separately, and a composite score from all rated items provides an overall score of the application (Figure 14). The SUQ scores can also be presented as a percentage rating as well. The average participants' rating was 89.32% ($SD = 8.48\%$).

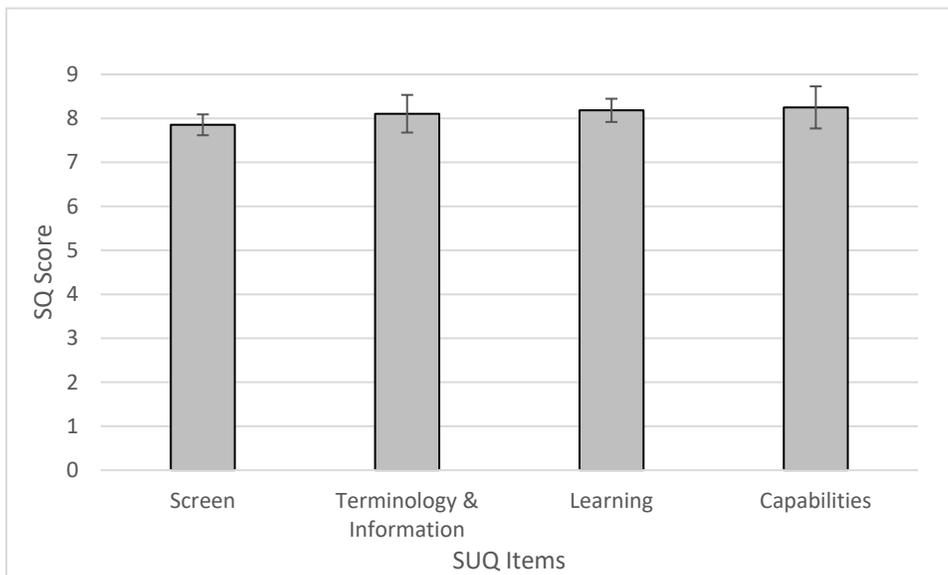


Figure 14. Average SUQ scores for each category across all participants

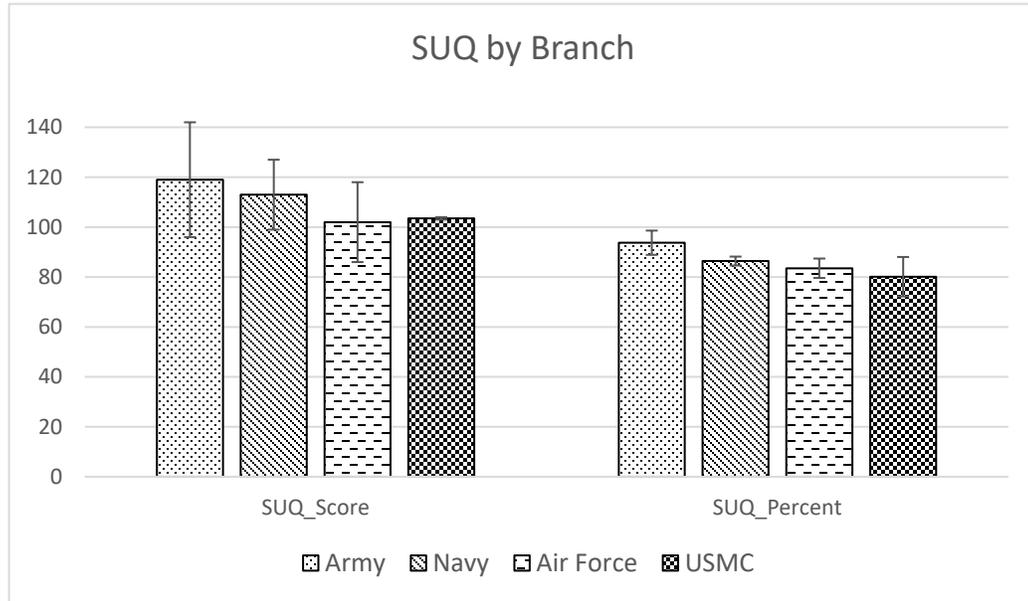


Figure 15. Subjective usability ratings by military branch across all items in the SUQ

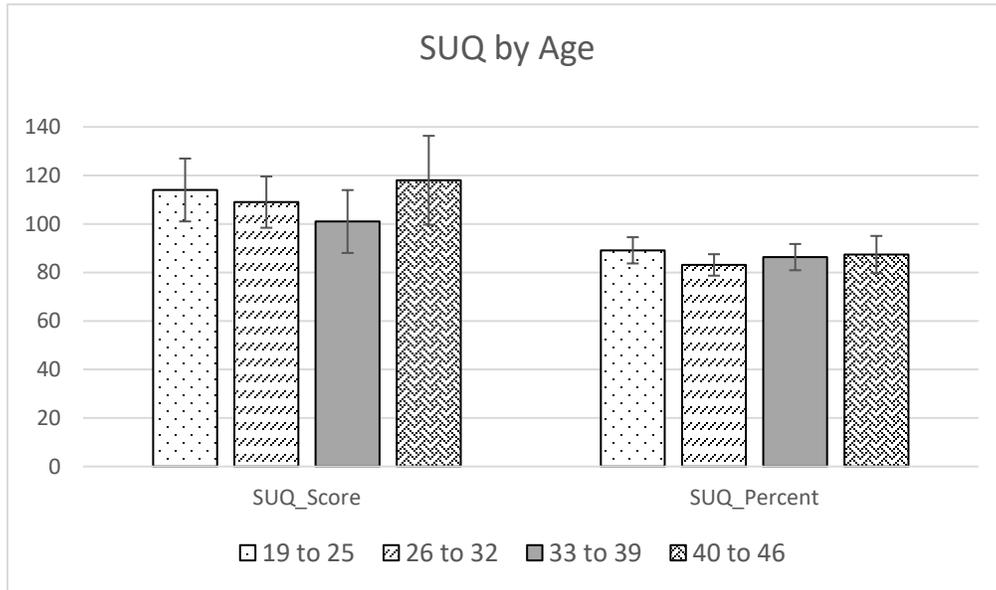


Figure 16. Subjective usability ratings by age range across all items in the SUQ

Participants rated the interface regarding the characters and icons as clear and easy to read. Regarding the terminology and system information, the participants rated the use of terms throughout the system as highly consistent and related to the tasks. High ratings suggest that the location of system notifications is consistent throughout the application, error messages are helpful, and areas requiring user input are clear. Additionally, the overall system transparency regularly keeps the users informed about the system’s functionalities and system states. Regarding the learning aspect of the application, participants rated the application as easy to use and easy to explore new features through trial and error. Participants found help messages on the screen to be helpful and found the supplemental reference materials to be clear. Participants also thought it was easy to remember names and use of commands as well as felt that the tasks could be performed in a straight-forward manner. Lastly, regarding system capabilities, participants thought they could easily correct their mistakes while interacting with the application. Average ratings across all participants for each item of the questionnaire are presented in Figure 17.

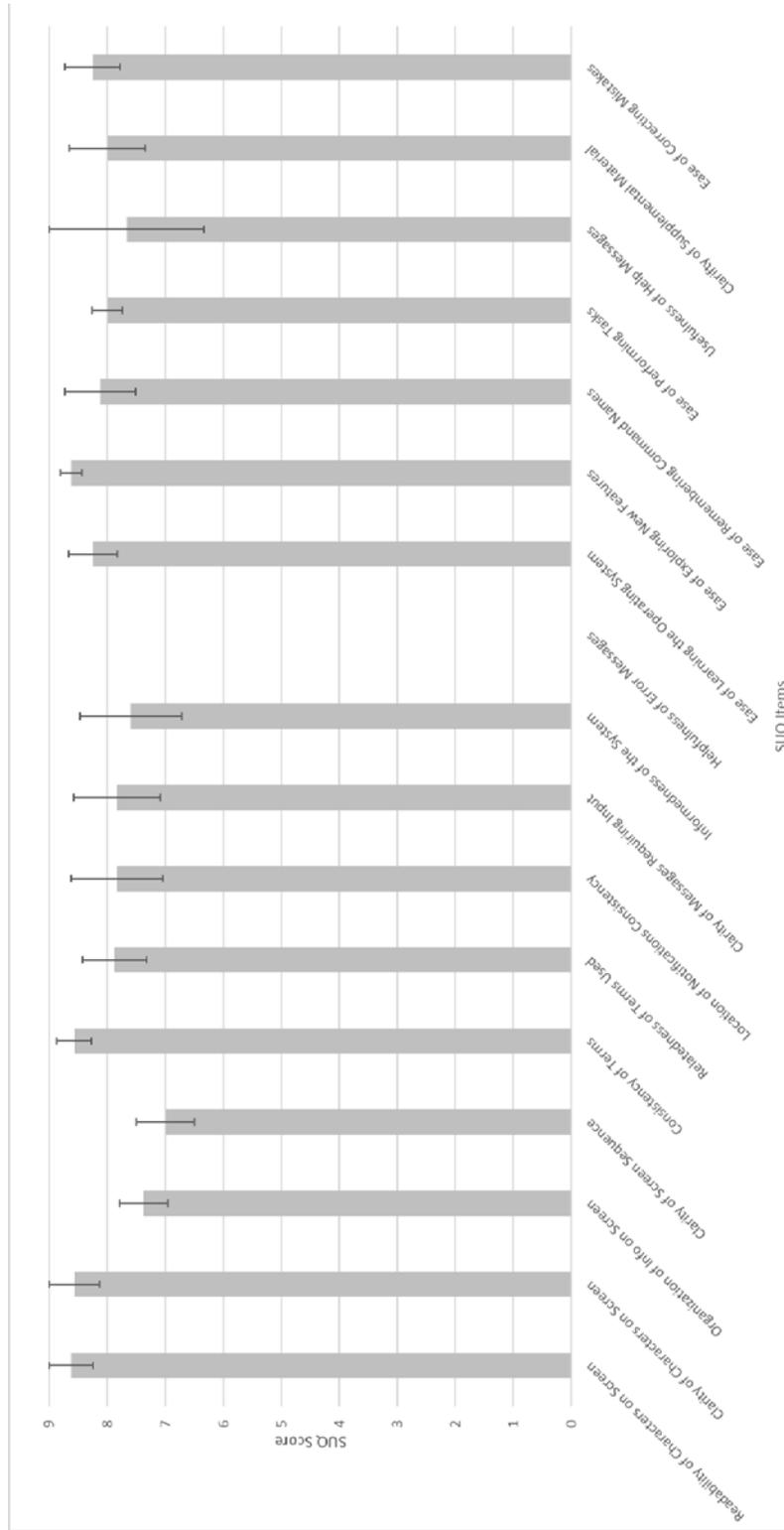


Figure 17. Participants' average SUQ ratings by item



System Usability Scale

The System Usability Scale (SUS) is considered the industry standard when it comes to determining ‘quick and dirty’ usability of systems, including software, hardware, mobile devices, websites and applications. The SUS is a simple 10-question, paper-based survey in which participants respond to usability questions using 5-point Likert items. The composite score of the items provides a single number representing the overall usability of the system and ranges from 0-100. The standard average for the scale is a 68 (Sauro, 2011), meaning scores above 68 are found to be above average, while scores below 68 are found to be below average. An adjective scale item was added to the questionnaire to provide an overall rating of the application. The addition of the adjective scale helps practitioners interpret individual SUS scores and aids in explaining the results to the lay-person. The scale ranges from 1 (worst imaginable) to 7 (best imaginable).

The results of the SUS indicate a mean score of 88.13 ($SD = 12.08$), meaning participants overall found the application to be above average compared to the scale standard average of 68 (Figure 18). The adjective rating scale resulted in an average rating of 6 indicating participants perceived the user-friendliness of the current version of the application as ‘excellent’ (Figure 19).

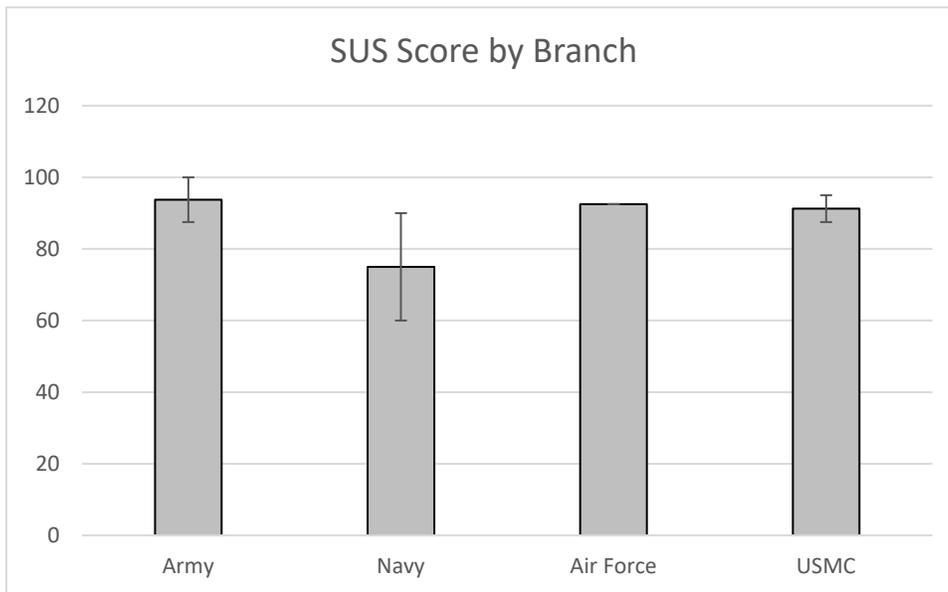


Figure 18. SUS score by military branch

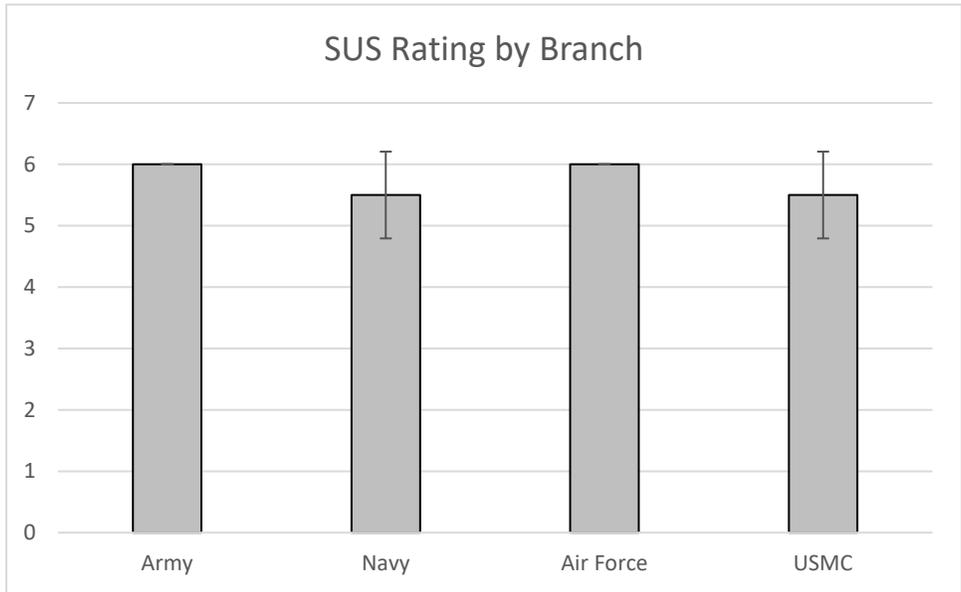


Figure 19. SUS rating by military branch

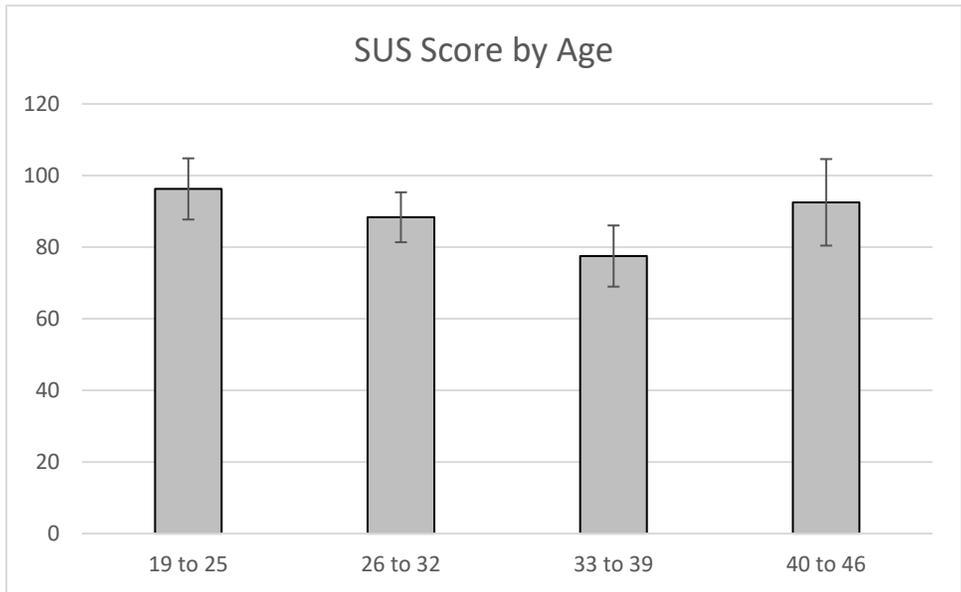


Figure 20. SUS score by age range

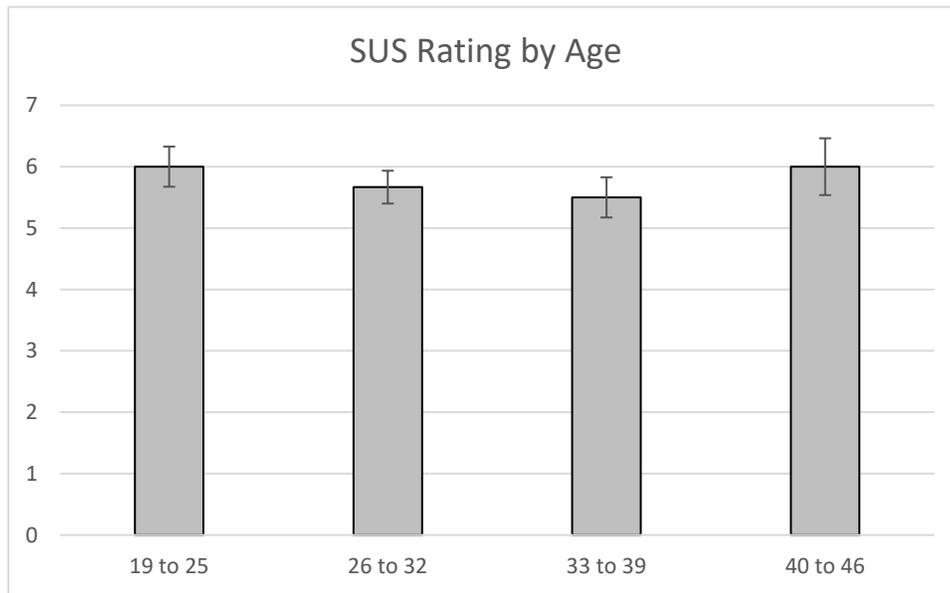


Figure 21. SUS rating by age range

Discussion

The general perspective across all the surveys was that the application was useful and rated ‘excellent’ in terms of user-friendliness, therefore, meeting the application goal.

The SQ provides a quick overall reaction to the system in terms of satisfaction. During the summative assessment, it was beneficial to use this short survey to gather insight into the participants’ overall perspective of their interaction with the application during the final stage of the software development. The rating of 86.67% indicates the participants were satisfied with their experience. Looking at individual questionnaire items reveals that participants perceived the application as useful, easy to use, flexible, and trustworthy, contributing to overall satisfaction with the application.

Eliciting a more detailed evaluation of the system, the SUQ provides specific feedback on four aspects of the application. One item on the questionnaire pertaining to error messages was not applicable and therefore removed from the analysis. The mean ratings were 89.32%, indicating participants positively perceived the application in terms of usability.

The SUS provides a general indication of usability in a relatively succinct time frame and with the addition of the adjective scale, which gauges a better interpretation of the participants’ ratings. The rating of 88.13% is well above the average (68%), which is interpreted as ‘excellent’ in terms of usability.

Overall, participants felt the application was useful and saw the potential for providing financial education. Additionally, through these assessments, specific recommendations were extracted to help improve the application further and are discussed in the Recommendations section below (Section 6).



3. Effectiveness

Methodology

Participants

Twenty-eight participants from across four branches of the military (U.S. Navy, U.S. Air Force, U.S. Marine Corps, and U.S. Army) stationed at Joint Base Pearl Harbor-Hickam, Marine Corps Base Hawaii, and Schofield Barracks, respectively, ($M_{age} = 32.18$ years; $SD = 7.63$; Men = 17, Women = 10) were recruited to participant in this study. All participants are currently serving in the military ($M_{service} = 10.23$ years; $SD = 6.77$), and each has a different career field within their respective service. Participants self-reported smartphone use (Table 2). One participant was not reported in the effectiveness evaluation analysis because they were unable to complete all knowledge challenge questions due to time limitations; however, their reactions to the application is included in the subsequent discussion and overall application recommendations. The qualifiers for participation were to be at least 18 years of age, current or former service member, and to be a naïve user to the Sen\$e application. Participants were instructed that their participation was voluntary, and that the evaluation could end at any time.

Table 2. Smartphone Usage Survey Responses – Effectiveness Participants

Survey Item	Average Response
What type of phone do you use?	11 Android; 15 iOS; 1 both Android and iOS devices
How long have you been using a smartphone?	7-10 years
How often do you use your smartphone?	3-4 hours a day
How often do you use your smartphone to:	
Check email	30 minutes a day
Play mobile games	45 minutes a day
Browse the internet	45 minutes a day
Use financial applications	30 minutes a day
Learn new information	45 minutes-1 hour a day

Procedure

Participants met with a study facilitator and note-taker at their respective military installation. Participants first read and signed the informed consent form and were introduced to the goals of the study. Next, participants completed a demographics questionnaire. Participants were then invited to take five minutes to freely explore the Sen\$e application. The study facilitator set a timer for the five-minute duration, and participants were handed the phone of their choice. Participants used the type of phone they indicated they were most comfortable using for the duration of the study (iPhone 7 Plus, iPhone 6s, Samsung Galaxy S7, or Google Pixel). A beta version of the application was presented on one of the four phones.

After the five-minute exploration, participants reviewed a total of five content areas, one area at a time, and completed a knowledge challenge for each content area. Paper-based challenge questions were administered that tested the participant’s knowledge and understanding of the content. Participants were allowed to use the application while answering the knowledge challenge questions, if needed. At the end of the evaluation, participants were asked to respond verbally to several debrief questions regarding their experience with the application. Participants were then thanked for their time and dismissed.



Test Scenarios

Test scenarios were identified by the project team based on available functionality of the application and reflected tasks which included a variety of in-application interactions and financial content. These scenarios required participants to navigate to key categories on the main dashboard like “Point of Need” and “Touchpoints.” The test scenarios were as follows:

Scenario 1: “Navigate to the ‘Divorce’ section. Here, you will review content from the ‘During the Divorce’ area.”

Scenario 2: “Navigate to the ‘Birth of a Child’ section. Here, you will review content from the ‘Post-Delivery’ area.”

Scenario 3: “Navigate to the ‘Disability’ section. Here, you will review content from the ‘Immediately After an Injury’ area.”

Scenario 4: “Navigate to the ‘Basic Finance’ section. Here, you will review content from the ‘Cash Flow’ area.”

Scenario 5: “Navigate to the ‘Vehicle Purchasing’ section. Here, you will review content from the ‘Cost of Owning a Vehicle’ area.”

Each scenario required participants to access and review content in a different content category from the dashboard. Their respective knowledge challenges ranged from three to four questions, and participants were allowed to use their devices while taking the challenges, if needed. All questions were scenario-based and were cross-validated for applicability and difficulty by at least two other members of the project team.

Data Collected

Participant responses to knowledge challenge questions were collected. Seventeen questions across five content categories were created utilizing the challenge questions located within each content area in the application. Content categories Divorce, Birth of a Child, Disability, Basic Finance, and Vehicle Purchasing were included in the knowledge challenge.

Data Analysis

Knowledge Challenge

Participant responses for the knowledge challenge questions were recorded and graded across each of the 17 questions within each of the five content sections (Divorce, Birth of a Child, Disability, Basic Finance, and Vehicle Purchasing; Figure 22). Data are presented across all participants, by military branch, and by age range. Age ranges were selected to capture equal numbers in each range.

Overall, participants scored an average of 82.57% ($SD = 17.05$) correct, with 71.60% ($SD = 33.20$) correct responses in the “Divorce” content, 93.83% ($SD = 2.14$) correct responses in the “Birth of a Child” content, 81.48% ($SD = 13.52$) correct responses in the “Disability” content, 100% ($SD = 0$) correct responses in the “Basic Finance” content, and 70.37% ($SD = 29.78$) correct responses in the “Vehicle Purchasing” content.

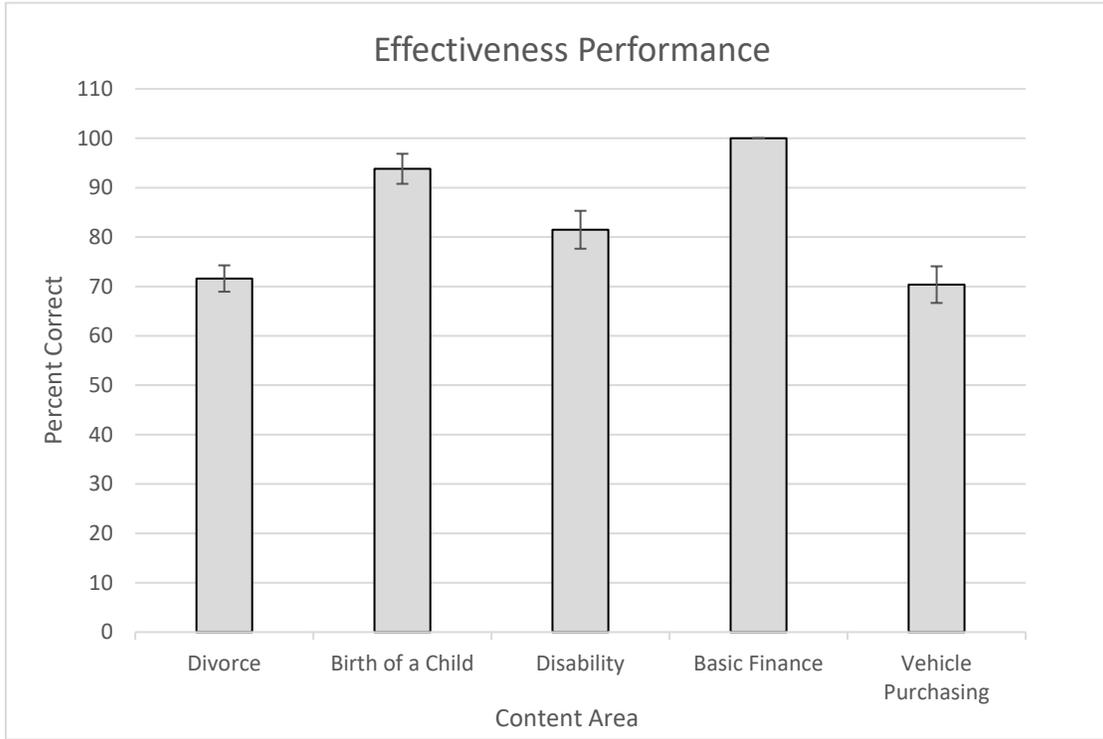


Figure 22. Participants' average performance score on all scenarios

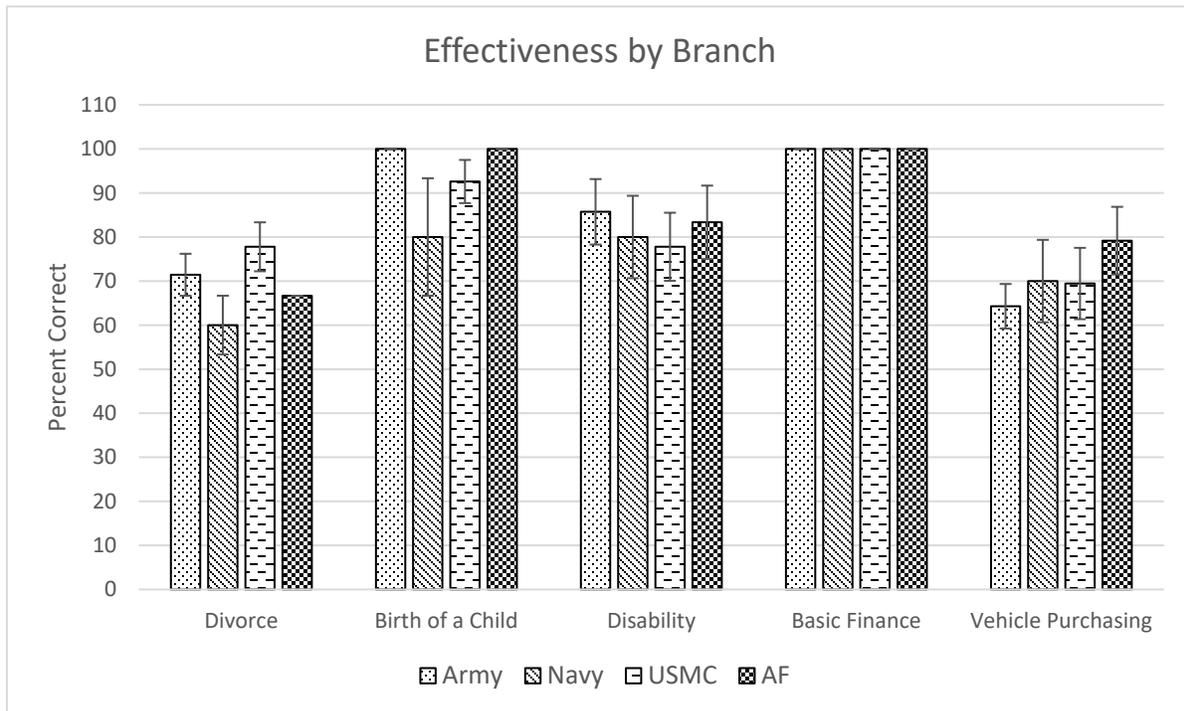


Figure 23. Knowledge Challenge scores by military branch

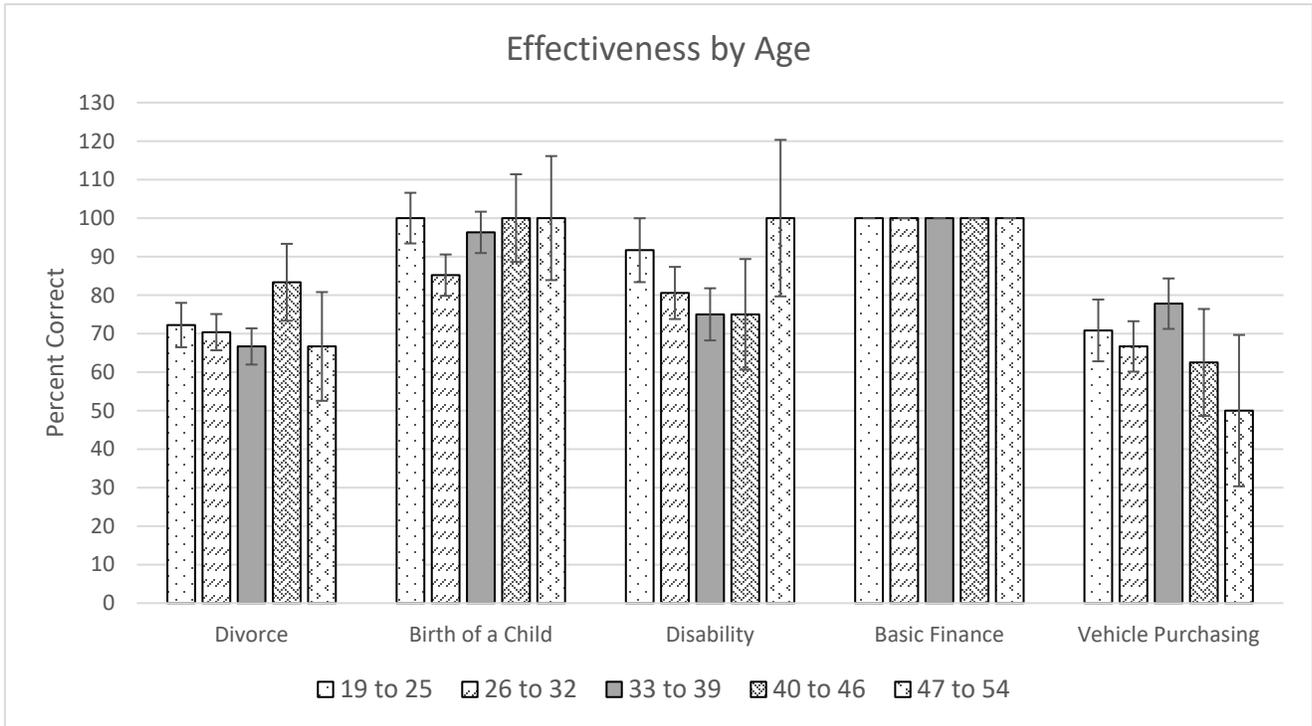


Figure 24. Knowledge Challenge scores by age range

Discussion

The effectiveness testing provides an overview of how successful the application was in presenting content that users could access on-the-go and during a point-of-need. Overall, participants were successful in obtaining and remembering financial concepts by navigating and reviewing content in the application. The results of the effectiveness evaluation suggest that Sen\$e is an effective learning tool.

4. Semi-structured Interviews

All participants were asked open-ended, semi-structured interview questions regarding their likes, dislikes, and suggested improvements for the Sen\$e application. The qualitative debrief findings for both groups of participants are consolidated here and a summary of participant responses is presented. A synthesis on the findings from these data have been incorporated into the list of recommendations.

Data Analysis

Data from the open-ended debrief questions were collected from 36 participants in total. Data were entered into Microsoft Excel, categorized based on question type (i.e., overall impressions, usefulness, expectations, learn anything, like most, like least, navigation, content organization, content terminology, anything to change/fix, anything missing, and final comment) and, where applicable for the usability data, test scenario number (1 - 4). Individual comments and responses were then coded based on recurring feedback found throughout and across the data which resulted in 27 unique codes. Six codes relate to overall application usability and usefulness and have a positive valance (easy to use, useful/helpful, easy to understand, thorough, learned something, wouldn't change anything). Two codes relating to errors or the indication of more tools or



calculators (connotation that the system was missing something) have a negative valence. The remainder of the codes relate to navigation, content location, redundant information, interactions, information, visualization, resources, terminology, and games have both positively- and negatively-valence coding (e.g., I liked the visuals/I did not like the visuals, etc.) The codes were vetted by two members of the project team. The number of times codes occurred across participants was summed and grouped into high-level themes made up of navigation, content, interaction, buttonology, status, aesthetics. These themes (Appendix A) will drive the overall recommendations stemming from the findings of this summative evaluation (usability and effectiveness testing). At a high level, the majority of participants specifically mentioned that Sen\$e was easy to use, useful or helpful, that they learned something, the interactions were what they expected, the information was useful or relevant, the terminology was good, and that they were able to navigate the application easily. Appendices C, D, and E contain the participant feedback in its original form and also categorized by both military branch and age.



5. Recommendations

From data analyses across usability testing and the effectiveness evaluation, the following recommendations are provided for consideration during future design and development iterations of the Sen\$e application. These recommendations have been categorized thematically and prioritized by the number of comments received about the specific issue with the intent of improving the user experience and usability of Sen\$e. Specific visual examples of recommendations are located in the Test Scenario Analysis section of this report; however, it should be noted that the examples provided there generally relate to Areas for Enhancement. Table 3 contains the complete list of these overall recommendations including items resulting from common areas of frustration or confusion.

Table 3. Main Recommendations

Theme	Issue	Recommendation
Navigation	The dashboard category term “Touchpoints” was overwhelmingly misunderstood. The term either was not relevant to participants or simply was not a known term. Navigation issues stemmed from categorization of content within the term “Touchpoints” on the main dashboard.	Renaming the dashboard category “Touchpoints” to something more intuitive, relevant, or common will help navigation errors and issues stemming from this uncommon nomenclature. It was noted that participants realized the contents of “Touchpoints” really meant areas significant to one’s military career. Only after looking at specific button headers (e.g., Initial Entry Training, First Duty Station, etc.) the category then made sense to participants. It was suggested that the category be renamed to “Military Touchpoints,” “Military Career,” or “Career Milestones.”
	Content location and organization seemed inconsistent. Some participants found the redundancy of content buttons across dashboard locations to be helpful, others found it to be overwhelming and a main cause for confusion in navigating to specified locations. However, the majority of participants noted that certain content was categorized incorrectly. Content categorization on the dashboard overwhelmingly did not meet expectations.	“Basic Finance” should be included in the “General” category, in addition to its original location within “At Initial Entry Training” in the “Touchpoints” category additionally, “Compound Interest” and “DTI Ratio” content buttons need to be removed from “Point of Need” category and placed and the “General” category.
	Participants found that the horizontal navigation across the dashboard was cumbersome, caused navigational issues, and they reported losing their sense of location within the application or forgetting what content was on screen previously.	It is recommended that the horizontal navigation be eliminated for dashboard navigation. Participants the up/down navigation that is more in line with standard app and phone dashboards or home screens. It is suggested that slightly smaller icons be used on the dashboard with larger title headers so that content is more salient. Additionally, content icons could be provided in



		collapsible menus (e.g. accordion menus) to allow for more information viewable in a vertical format.
	A navigation issue related to buttonology, participants desired a “Dashboard” button that navigated them “home” to the main dashboard. Depending on what level on content the participant was in, the “Dashboard” button brought them to a <i>sub-category dashboard</i> and not the main dashboard.	To reduce the frustration participants felt during their interaction with the “Dashboard” button, it is recommended to add a “Home” button that will navigate participants to the home screen (main dashboard) from anywhere within the application (each screen should then contain a “Home” button). Additionally, it is recommended to include a <i>sub-dashboard</i> navigation functionality (e.g., button) that will bring users out to the touchpoint options (see Figure 3b for an example of this sub-dashboard screen).
	Participants had a navigational issue related to buttonology and desired a “Dashboard” button that navigated them “home” to the main dashboard. Depending on what level on content the participant was in, the “Dashboard” button brought them to a <i>sub-category dashboard</i> and not the main dashboard.	Include a “Home” icon or button on every screen that will bring users out to the home screen/main dashboard.
	In the “Birth of a Child” area, many participants could not discern the difference between content titles “Planning for a Child” and “Pre-Delivery.” It confused them on where to navigate to in order to complete the test scenario.	It could be that a simple title change alluding to distinct and disparate information is needed to help users find relevant content and to reduce errors locating that content.
Content	Participants expected and wanted to see a resources page for all potential weblinks and additional information. While resources and weblinks are included on individual screens within specified content, a consolidated view was requested by a large portion of participants.	Within the “Resources” category on the dashboard, it is recommended to include a consolidated resource content button that will house all resources contained in the application and categorized by resource type.



	<p>Participants' single-most requested item for the application was the inclusion of tools and calculators. These ranged from spreadsheets, budgets, forecasting calculators, loan amortization schedules, investment projectors, etc. Mainly, participants wanted to be able to input their own figures (not necessarily linked or required to be linked to personal financial information) to be able to create more informed decisions and support more personalized/relevant learning. Many participants in leadership roles mentioned the need for vehicle and mortgage/housing calculators to help support healthy financial decisions in their younger, more junior members.</p>	<p>It is recommended to include common financial tools/calculators supporting the financial topics included in Sen\$e. These may encompass budgeting tools, spending plan spreadsheets, loan forecasting calculators, amortization schedules, interest calculators, investment projection calculators, retirement tools, and COLA/BAH/benefits/entitlements calculators to name a few. Additionally, in the recommended "Resources" content, web-links to approved and verified sites for common calculators can be included as well.</p>
	<p>Participants felt that some content sections contained information that was too basic or too general. Rather than err on the side of too basic, it seemed that participants wanted more thorough information. Specifically mentioning the "Basic Finance" section "Cash Flow," participants felt this section was incredibly basic and they expected to find information that they would not necessarily have known about.</p>	<p>To strike a balance between bloating the application with complex content that exists elsewhere on approved government and military websites and providing the user with what they want and expect in a financial application, it is recommended that basic financial information be kept in the application to ensure that users who do not have knowledge on such topics can remain informed. While the average age of participants in the effectiveness study was 32 years, the application will support a wide age range, including 18-year-old junior members.</p>
	<p>Several participants reported being confused by the two interactive green boxes located within the "Compound vs. Simple Interest" area. It was not clear to participants that the figures they entered within the first green box, "Let's try it out," related to the second green box, "Compare the two."</p>	<p>One way to create a relation between the two interactive areas located in this section is to move them closer together in physical space by moving the text between the interactive areas to a location preceding the interaction. Confusion caused on this screen can also be reduced by adding some text to alert the user that now they will be comparing what they just previously entered.</p>
	<p>The graphic located in "Compound vs. Simple Interest" is a representation of money earned for both simple and compound interest, the <i>money tree</i> analogy, but many participants felt that it lacked informative elements. They wanted a graphic or table that would help them easily recognize differences</p>	<p>It was suggested that, with all the unused space on the screen, a veridical representation of simple vs. compound interest be used, rather than a stylized money tree graphic. A bar graph or line graph was mentioned, along with the dollar amount differences automatically calculated for the user, to be presented in this area.</p>



	between the simple and compound interest calculations.	
Interaction	Many participants noted some difficulty with the slider bar interaction designated for user input in the “Compare the two” area. The slider bar is used to denote how many years simple or compound interest has been accruing. The initial interaction gesture performed by participants was to tap on an area within the bar, expecting that the orange scrubber would snap-to-location.	Improving the responsiveness of the slider bar to accept a tap in a location rather than only a hold and slide interaction would rectify this issue.
Buttonology	In certain areas, participants noted that interaction arrow buttons either obscured information or appeared out of context with the content located on screen. These buttons did not meet user expectations.	Across the application, where applicable, buttons that replace gesture interactions should be removed and/or the common gesture should be available for use in navigating to specified content or locations. Specific instances of this issue are the “Basic Finance” – “Banking Services and Fees” flip book interaction and the “Birth of a Child” – “Post-Delivery” flip book interaction. It is recommended to remove the arrow button and replace with the swipe-for-more gesture common in other mobile apps. If arrow icons are preferred, it is recommended to make the association between the content and the navigational buttons more salient.
	Several participants tapped on the header of the table (“Details”) located in the “Short-term Disability” area on the page. In these cases, participants mentioned that they believed the area to be an interactive button and tapping on it would have expanded to show more information.	To reduce the appearance that the table header is an interactive button, it is recommended to change the look of the header to be less like an interactive button. Changing the header to match similar text headers with a subsequent bulleted list instead of a table-like look will reduce similarities to interactive buttons on the screen.
Status	The majority of participants had difficulty in accessing the “Challenge” at the end of the content during both the usability testing and effectiveness evaluation. The system lacked status notifications and failed to alert participants as to what was expected of them in order to access the challenge. Participants did not know what to do in order to access the challenge and were confused on why they could not interact with the challenge.	It is recommended that users receive guidance or instructions regarding the activation of the challenge. Placing the challenge activation in context within the content setting can take many forms (e.g., a pop-up notification, a set of instructions at the beginning of the text, reactive feedback associated with either scrolling to or tapping on a grey challenge button). Another recommendation would be to remove the requirement that all content be viewed before the challenge activates. In this way, users can leisurely



		<p>and unobtrusively explore and navigate the content at their discretion.</p> <p>Additionally, utilizing the current progress bar but making it more informative and salient may help users in recognizing their status. Displaying percentages on the progress bar or changing the colors of the progress bar to make the appearance of progress through the content more apparent would support progress tracking. Increasing the size of the progress bar may also help the saliency of the users' progress through the content and, in turn, informing users of how close they are to completing the section</p>
Aesthetics	The application met participants' expectations regarding aesthetics, look and feel. At this time, no recommended improvements are offered.	



6. References

- Brooke, J. (1996). SUS: A "quick and dirty" usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester & I. L. McClelland (Eds.), *Usability evaluation in industry* (pp. 189-194). London: Taylor & Francis.
- Lewis, J. (1995). IBM computer usability satisfaction questionnaires: Psychometric evaluation and instructions for Use. *International Journal of Human-Computer Interaction*, 7(1), 57-78.
- Sauro, J. (2011). *A practical guide to the system usability scale*. Denver, CO: Measuring Usability LLC.



7. Appendix A – Usability Themes

A summary of participant comments regarding the six main themes were collapsed across common coding schemes. With more than 100 individual data points, clear patterns emerged and consisted of feedback about navigation, content, interactions, buttonology, system status, and aesthetics are presented in Table 4.

Table 4. Participant Responses to Debrief Questions regarding interaction with Sen\$e

Themes	Like best?	Like least?	What was missing/should be added?	General thoughts
Navigation (General, Organizational, Naming Conventions)	<ul style="list-style-type: none"> • The application was easy to navigate • Layout was helpful, and the dashboard was separated in a way that made navigation easier • The “What’s Ahead” summary screen before the content was helpful 	<ul style="list-style-type: none"> • The category name “Touchpoints” is not relevant or helpful • “Point of Need” contained information that did not seem like it went with the rest of the <i>life events</i> in the section • Requires some getting used to, especially with knowing where things are located • Did not like having to scroll through every header (i.e., content buttons) • The “table of contents” in each area is bland (the green/white/orange area) • Did not like the scroll left/right function of the dashboard 	<ul style="list-style-type: none"> • Suggestions to change the name of the “Touchpoint” category title to something more familiar to users, like “Career Points” or “Military Touchpoints” • A good algorithm for the search functionality located within the application • A dashboard button that navigates back to the main dashboard or “home screen” (also included in buttonology) • A description of the overall application or tutorial might be helpful 	<ul style="list-style-type: none"> • Vertical and horizontal scrolling on the dash seemed unfamiliar and “weird,” participants preferred to navigate up and down
Content	<ul style="list-style-type: none"> • Content was generally in an area that was expected • Content was useful • Content was informative • Provides information all in one place • Provides a lot of information • Seems comprehensive • Great “jumping off point” for financial areas that may not be familiar 	<ul style="list-style-type: none"> • Some content was not in an area that was expected • Strange that basic finance was only located in Initial Entry training and not somewhere more general • Some content seemed to be duplicated in areas • Information in some areas like “Cash Flow” seems too simplified • Content is not eye catching 	<ul style="list-style-type: none"> • More detailed information in sections • Needs more tools and calculators across all areas • Needs more videos or interactive features 	<ul style="list-style-type: none"> • Lack of images in the table of contents makes the app seem underdeveloped



	<ul style="list-style-type: none"> • Like that resources to weblinks are provided • Glossary terms are helpful/convenient 			
Interactions	<ul style="list-style-type: none"> • Interactions met expectations • Interactions were “smooth” and responsive • Interactions seemed similar to other apps and websites, they were intuitive 	<ul style="list-style-type: none"> • Expecting more interactions – like plug and play or tools to help me budget • Slider bar in “Compare Compound vs. Simple Interest” section needs to be more responsive/sensitive • Accordion menu did not respond as expected and did not like how it moved up when opening a new area 	<ul style="list-style-type: none"> • Needs more interactions • Needs more tools and calculators, areas for user input • Needs interactive case-studies • Area for personalized spreadsheets or budgeting tools 	• N/A
Buttonology	<ul style="list-style-type: none"> • Likes that buttons are pictures • Buttons seem clear • Buttons are easy to tap on • Button titles made the sections on the dashboard clearer • Links and glossary term buttons were clearly interactive and intuitive • “+” (plus) marks on accordion made it clear that there was more information to open up 	<ul style="list-style-type: none"> • Back button did not work as expected • Dashboard button did not bring the user “Home” • Table header was thought to be a button • Greyed out “Challenge” button • Some buttons in certain sections do not make sense – like “Compound Interest” in “Point of Need” area • Buttons need to be smaller on the dashboard, so user can see more options • Arrow on flipbook interaction did not look like it belonged there • “Challenge” question “Submit” button not in an expected location – majority of apps have a button to move forward on the right side • Question mark icon in the “Compare Compound vs. Simple Interest” area did not meet expectations – wanted more information about what figures needed to go in the text field • The pie chart interaction in “Birth of a Child” is kind of difficult to navigate because the arrow button is cutting off a lot of the graphic 	<ul style="list-style-type: none"> • Something that would tell users why the “Challenge” button is not activated • Utilize hamburger menu more to help users navigate, expected more options when tapping on the menu button 	• N/A



Status	<ul style="list-style-type: none"> •N/A 	<ul style="list-style-type: none"> •Users not sure of status and what to do to access the challenge at the end of the content •Icon suggested a weblink but then system notification said, “PDF unavailable” and user was confused 	<ul style="list-style-type: none"> •Need a notification to alert users on what to do to activate the “Challenge” button •A clear indicator about progress through content or where user is in the application 	<ul style="list-style-type: none"> •N/A
Aesthetics	<ul style="list-style-type: none"> •Liked how switching to landscape mode the application accommodated the phone rotation •Appeals to the “millennial mind” •Likes the pictures on the dashboard •Colors are nice •Likes how the Challenge feedback blocks out the rest of the screen to reduce distractions •Likes how the Challenge question appears a bit after the feedback pop-up is presented •Dashboard looks really nice •Application is simple •Likes that it is sponsored by DoD •Likes that the app is specifically for the military 	<ul style="list-style-type: none"> •Application is bland •Table of contents screen is boring •The design is basic, and it is too much of the same •There is a lot of content, but it is not eye catching •Look and feel of the application is basic 	<ul style="list-style-type: none"> •N/A 	<ul style="list-style-type: none"> •N/A

8. Appendix B – Usability Questionnaires

Satisfaction Questionnaire (SQ)

Directions: Please answer the following questions as completely as possible. Place a circle around the number that best represents your rating of your experience.

OVERALL REACTIONS TO THE SOFTWARE

useless	0	1	2	3	4	5	6	7	8	useful	N/A
difficult	0	1	2	3	4	5	6	7	8	easy	N/A
frustrating	0	1	2	3	4	5	6	7	8	satisfying	N/A
rigid	0	1	2	3	4	5	6	7	8	flexible	N/A
untrustworthy	0	1	2	3	4	5	6	7	8	trustworthy	N/A



Subjective Usability Questionnaire (SUQ)

Directions: Please answer the following questions as completely as possible. Place a circle around the number that best represents your rating of your experience.

SCREEN

1. Characters on the computer screen

hard to read									easy to read	
1	2	3	4	5	6	7	8	9	N/A	

vague									obvious	
1	2	3	4	5	6	7	8	9	N/A	

2. Organization of information on screen

confusing									very clear	
1	2	3	4	5	6	7	8	9	N/A	

3. Sequence of screens

confusing									very clear	
1	2	3	4	5	6	7	8	9	N/A	

TERMINOLOGY AND SYSTEM INFORMATION

4. Use of terms throughout system

inconsistent									consistent	
1	2	3	4	5	6	7	8	9	N/A	

5. Terminology used is related to the task you are doing

never									always	
1	2	3	4	5	6	7	8	9	N/A	

6. Location on screen of messages and notifications provided to you by the system

inconsistent									consistent	
1	2	3	4	5	6	7	8	9	N/A	

7. Messages that require your input are?

confusing									clear	
1	2	3	4	5	6	7	8	9	N/A	

8. System keeps you informed about what is going on

never									always	
1	2	3	4	5	6	7	8	9	N/A	

9. Error messages

unhelpful									helpful	
1	2	3	4	5	6	7	8	9	N/A	



LEARNING

10. Learning to operate the system

difficult	1	2	3	4	5	6	7	8	easy	9	N/A
------------------	---	---	---	---	----------	---	---	---	-------------	---	-----

11. Exploring new features by trial and error

difficult	1	2	3	4	5	6	7	8	easy	9	N/A
------------------	---	---	---	---	----------	---	---	---	-------------	---	-----

12. Remembering names and use of commands

difficult	1	2	3	4	5	6	7	8	easy	9	N/A
------------------	---	---	---	---	----------	---	---	---	-------------	---	-----

13. Tasks can be performed in a straight-forward manner

never	1	2	3	4	5	6	7	8	always	9	N/A
--------------	---	---	---	---	----------	---	---	---	---------------	---	-----

14. Help messages on the screen

unhelpful	1	2	3	4	5	6	7	8	helpful	9	N/A
------------------	---	---	---	---	----------	---	---	---	----------------	---	-----

15. Supplemental reference materials

confusing	1	2	3	4	5	6	7	8	clear	9	N/A
------------------	---	---	---	---	----------	---	---	---	--------------	---	-----

SYSTEM CAPABILITIES

16. Correcting your mistakes

difficult	1	2	3	4	5	6	7	8	easy	9	N/A
------------------	---	---	---	---	----------	---	---	---	-------------	---	-----



System Usability Scale (SUS)

Please check the box that reflects your immediate response to each statement. Don't think too long about each statement. Make sure you respond to every statement. If you don't know how to respond, simply mark "3."

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>				
	1	2	3	4	5
2. I found the system unnecessarily complex	<input type="checkbox"/>				
	1	2	3	4	5
3. I thought the system was easy to use	<input type="checkbox"/>				
	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	<input type="checkbox"/>				
	1	2	3	4	5
5. I found the various functions in this system were well integrated	<input type="checkbox"/>				
	1	2	3	4	5
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>				
	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	<input type="checkbox"/>				
	1	2	3	4	5
8. I found the system very cumbersome to use	<input type="checkbox"/>				
	1	2	3	4	5
9. I felt very confident using the system	<input type="checkbox"/>				
	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	<input type="checkbox"/>				
	1	2	3	4	5

Overall, I would rate the user-friendliness of this system as (circle one only)

Worst Imaginable
 Awful
 Poor
 Fair
 Good
 Excellent
 Best Imaginable



9. Appendix C – Semi-Structured Interview Data: Coded

Table 5. Semi-structured interview data: Coded

Code Category	# of Participants
Useful/Helpful	23
Easy to use	20
Learned something	15
Thorough/Like that it's all in one place	8
Easy to understand content	5
Would not change anything	3
More Tools/calculators (esp. for your own information)	15
Errors	3
Navigation – good	19
Navigation – needs improvement	8
Content Location - expected	15
Content Location – not where expected	13
Redundant Info – helpful	3
Redundant Info – bothersome	3
Interactions – expected	13
Interactions – did not work as expected	1
Information – good/helpful/relevant	21
Information – too general	9
Information – wanted more (not relevant to finance)	1
Visualization – liked the visuals	11
Visualization – did not like the visuals	3
Resources – good	7
Resources – lacking/too limited	4
Terminology – good/helpful	17
Terminology – confusing	0
Games – liked the games	5
Games – did not like the games	6

**Items in grey have a negative valence.*



10. Appendix D – Semi-Structured Interview Data Graphs by Branch

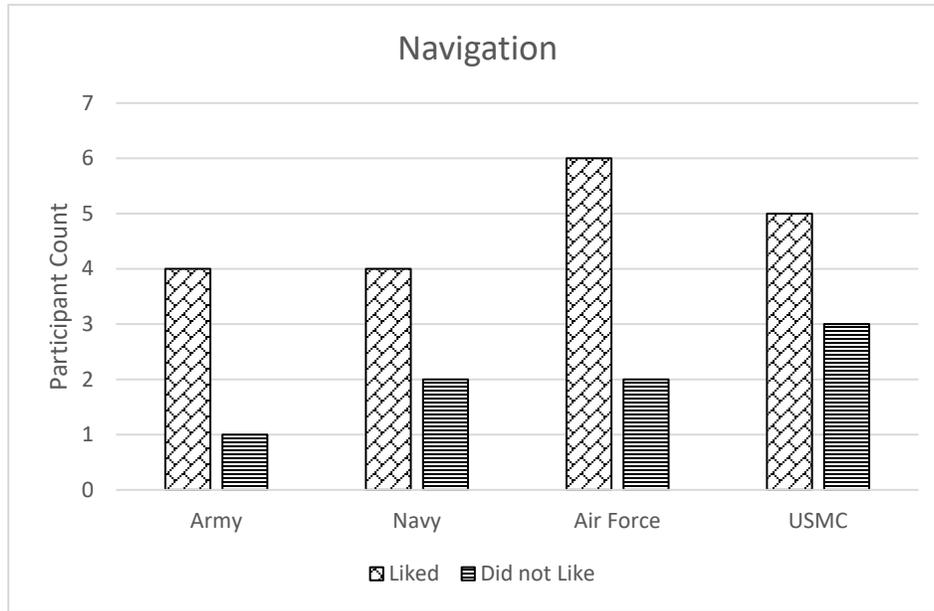


Figure 25. Dual valence comments made about navigation by military branch

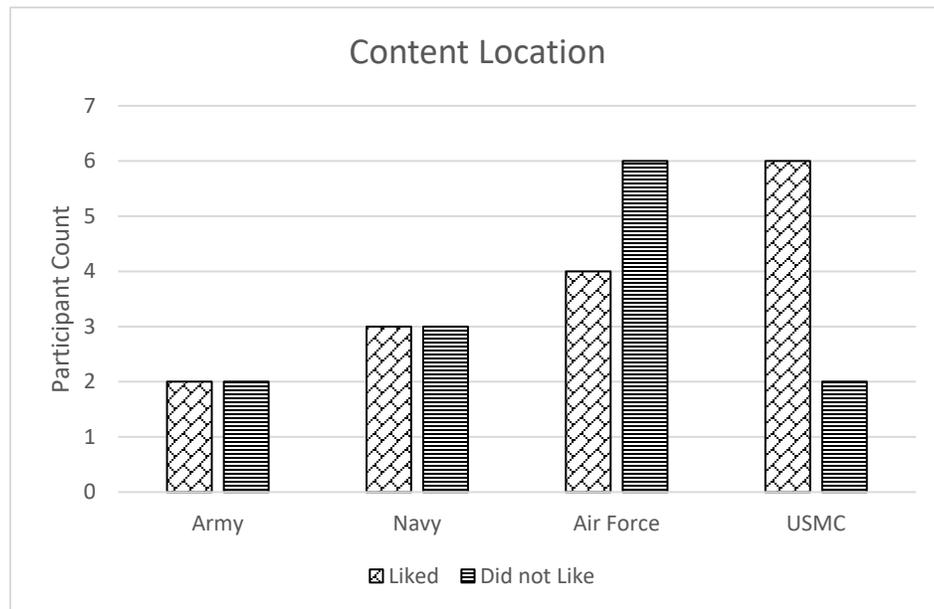


Figure 26. Dual valence comments made about content location by military branch

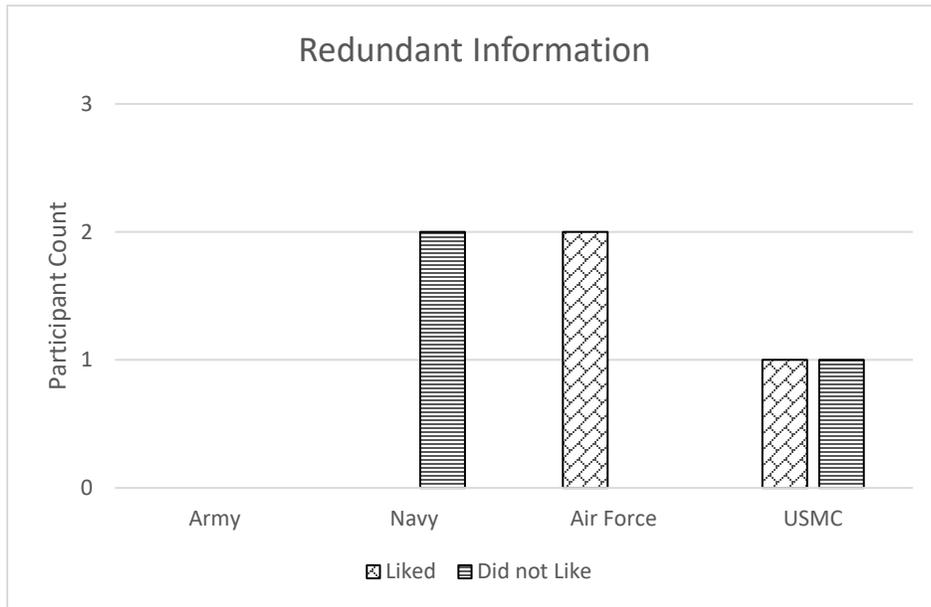


Figure 27. Dual valence comments made about redundant information by military branch

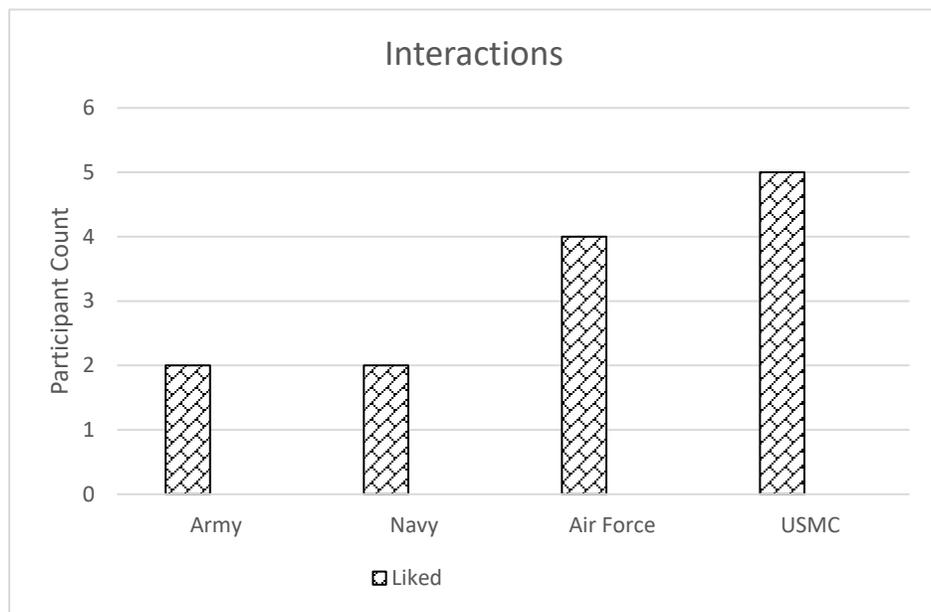


Figure 28. Dual valence comments made about interactions by military branch

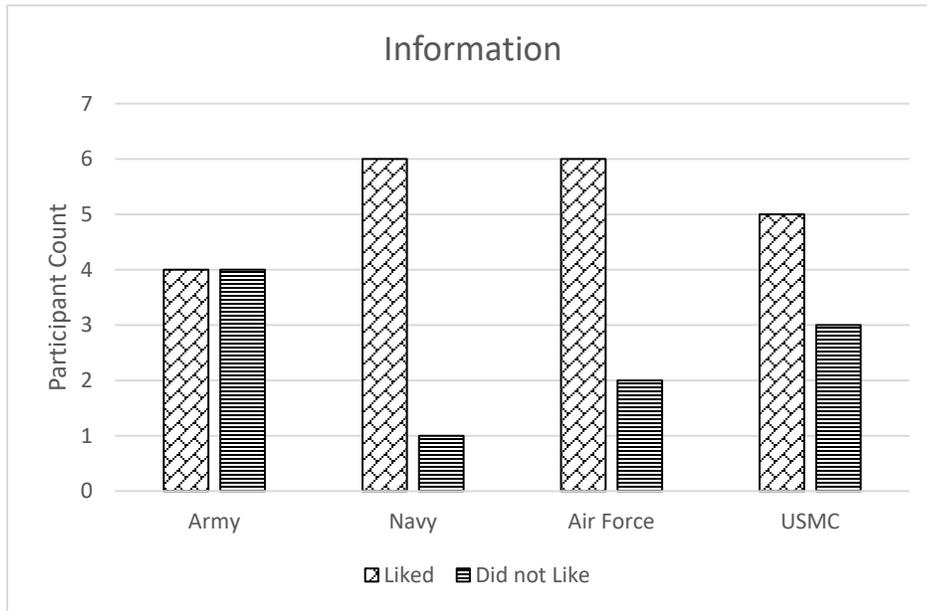


Figure 29. Dual valence comments made about usefulness of information by military branch

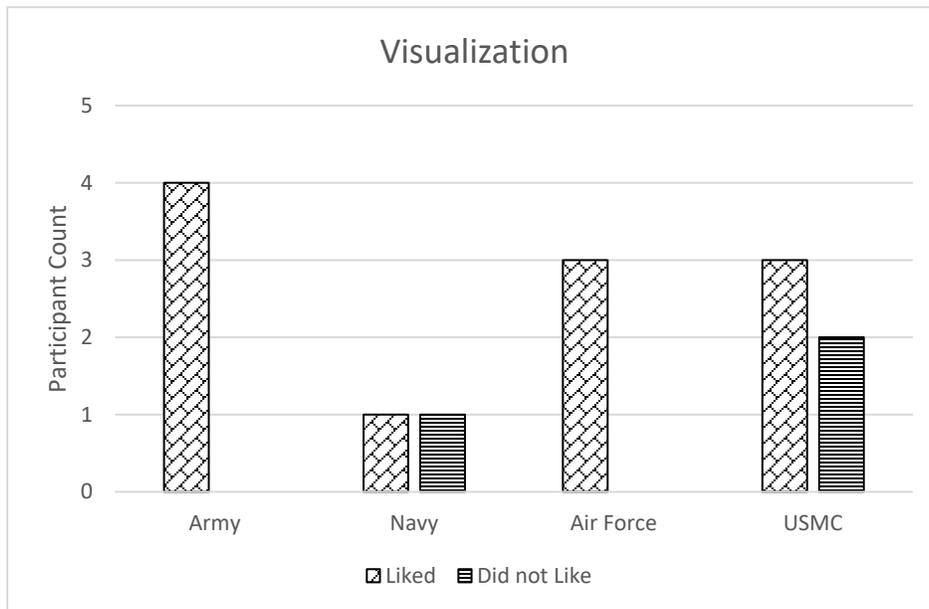


Figure 30. Dual valence comments made about visualization by military branch

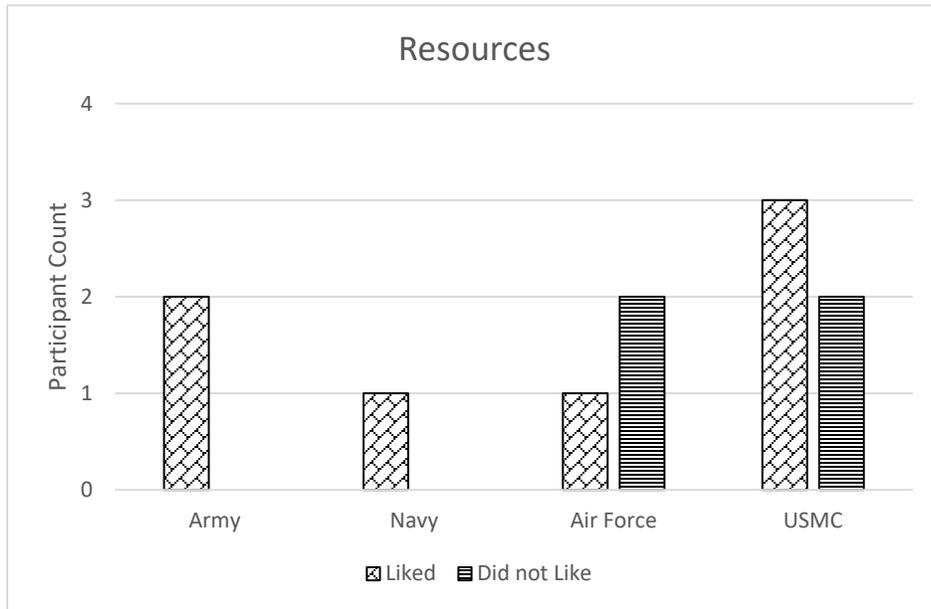


Figure 31. Dual valence comments made about resources by military branch

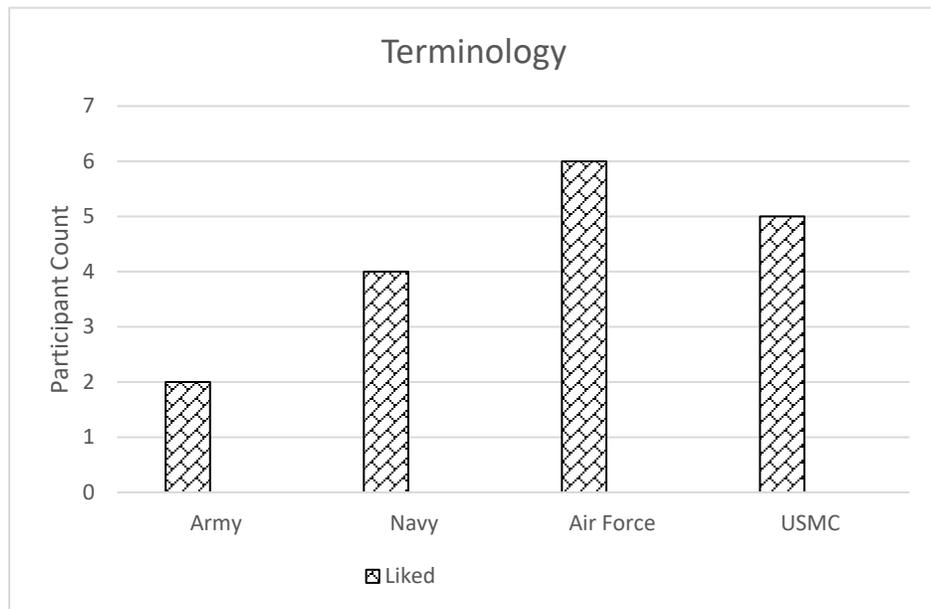


Figure 32. Dual valence comments made about terminology by military branch

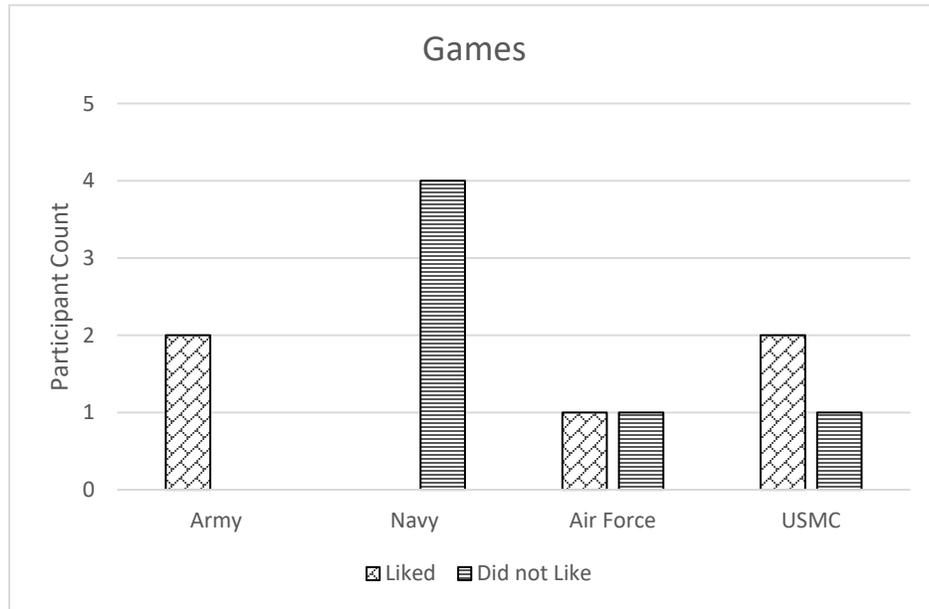


Figure 33. Dual valence comments made about games by military branch



11. Appendix E – Semi-Structured Interview Data Graphs by Age

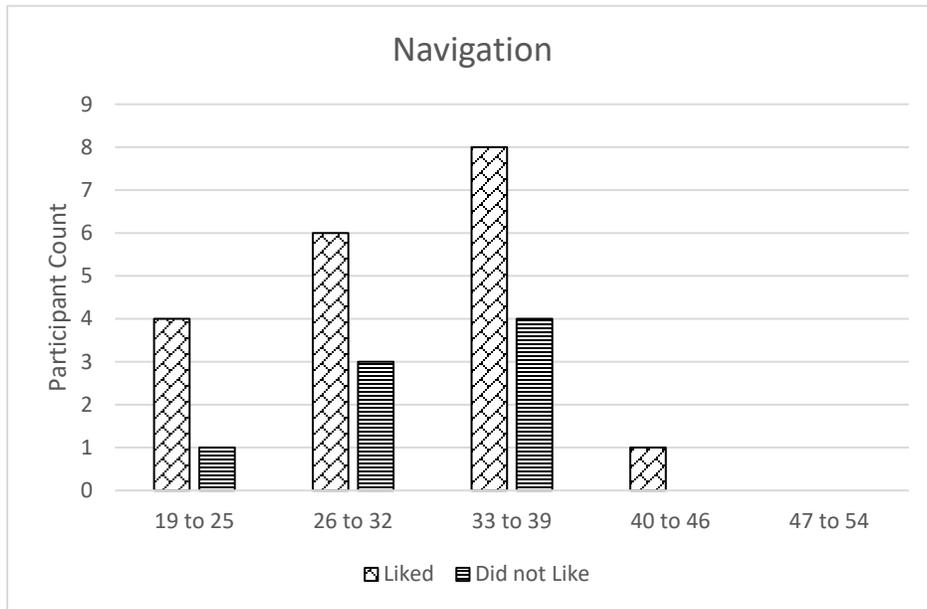


Figure 34. Dual valence comments made about navigation by age range

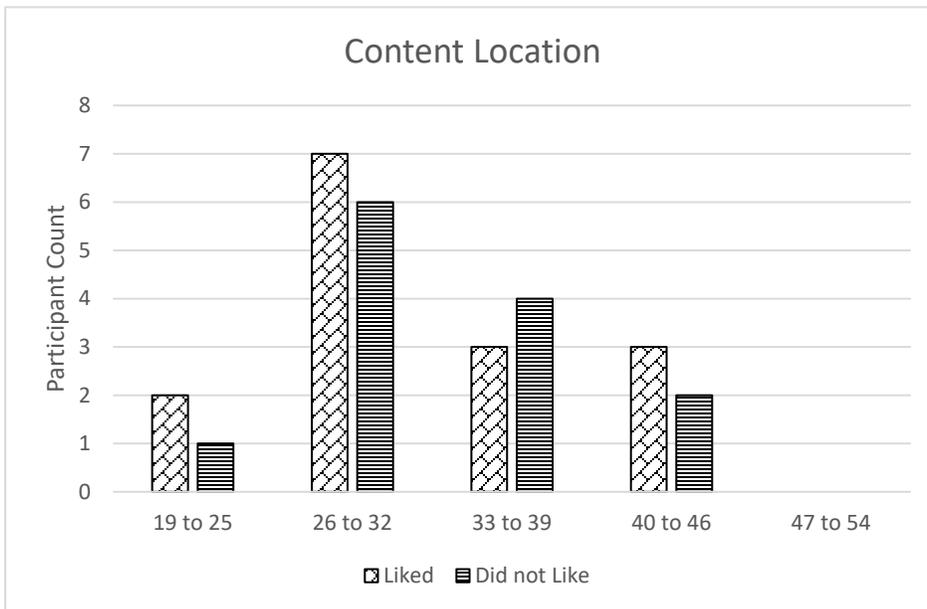


Figure 35. Dual valence comments made about content location by age range

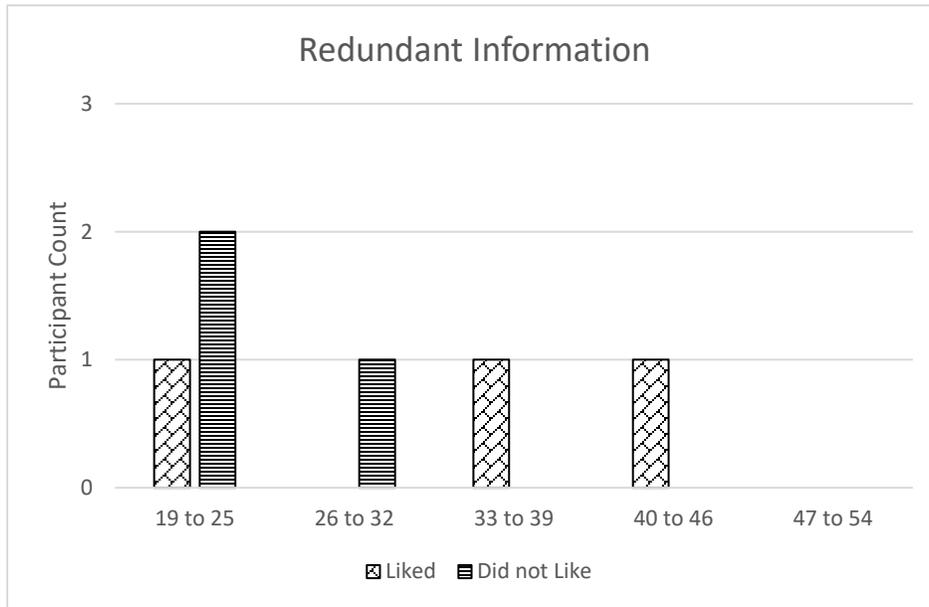


Figure 36. Dual valence comments made about redundant information by age range

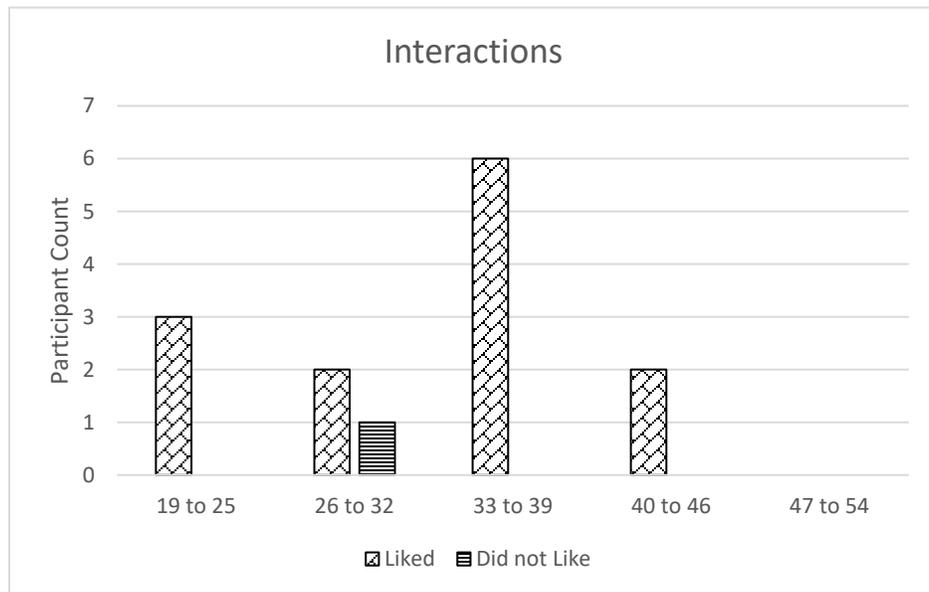


Figure 37. Dual valence comments made about interactions by age range

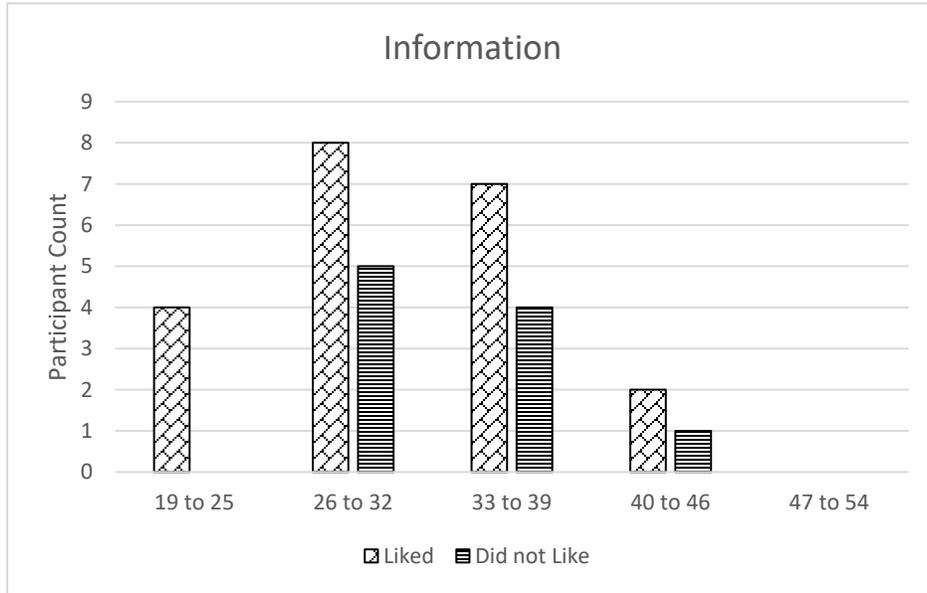


Figure 38. Dual valence comments made about usefulness of information by age range

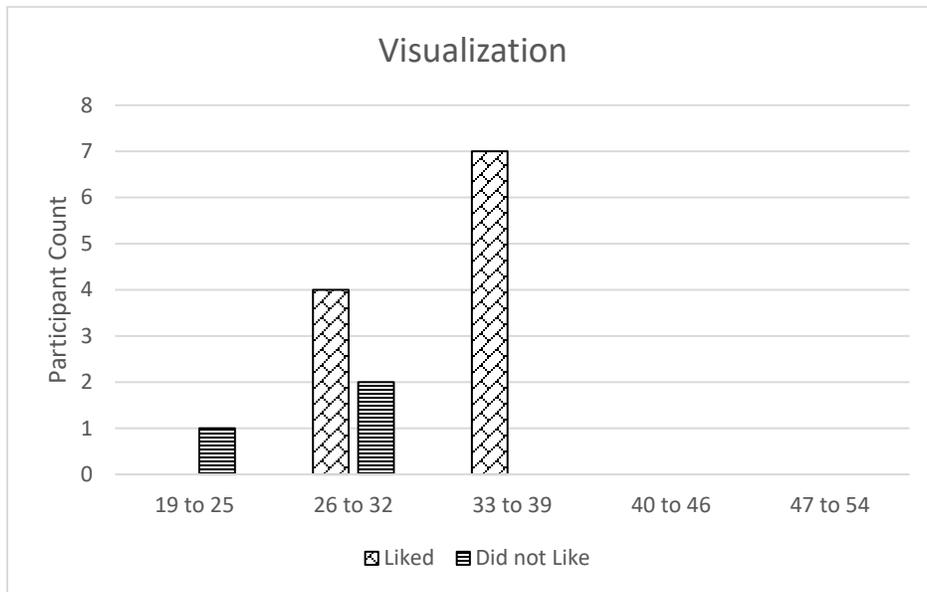


Figure 39. Dual valence comments made about visualization by age range

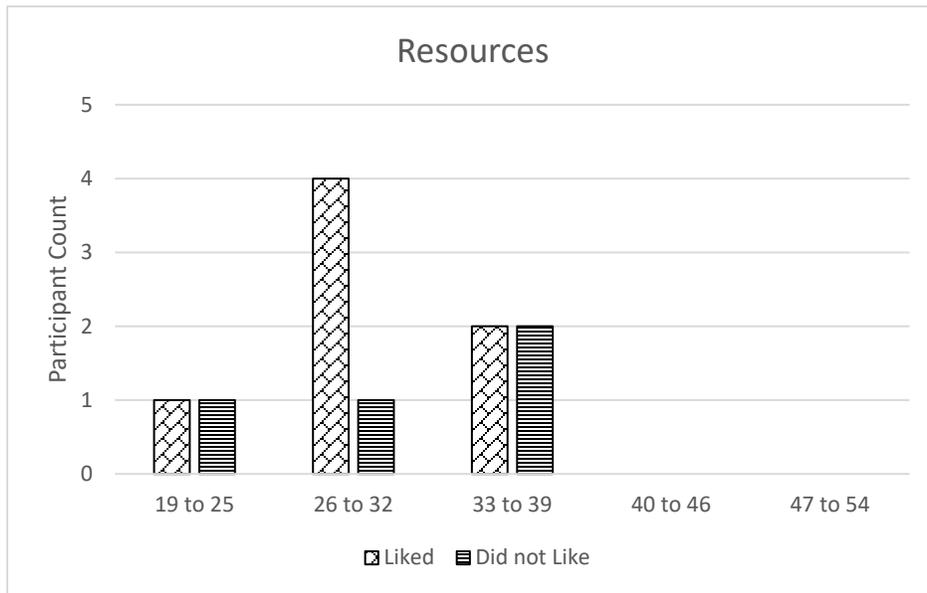


Figure 40. Dual valence comments made about resources by age range

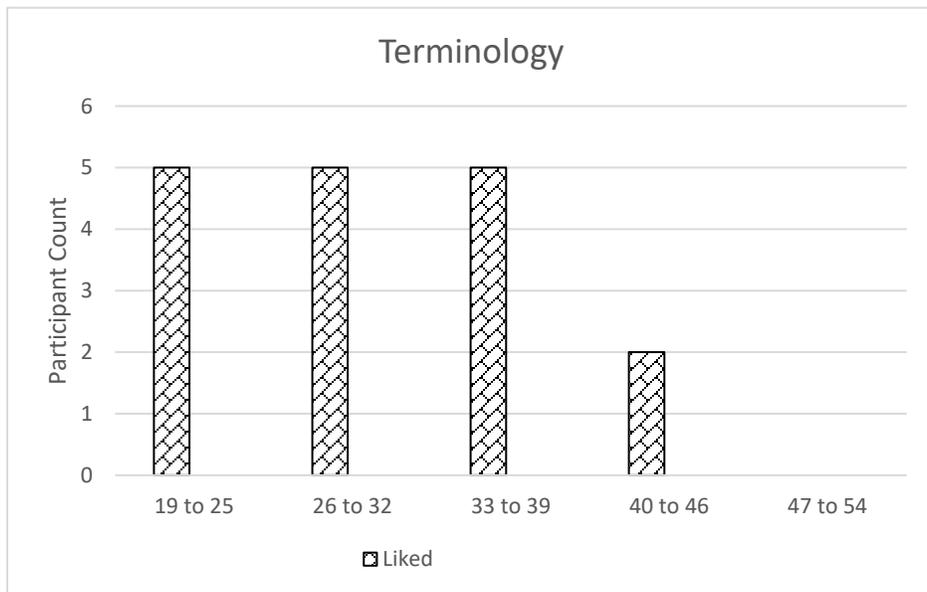


Figure 41. Dual valence comments made about terminology by age range

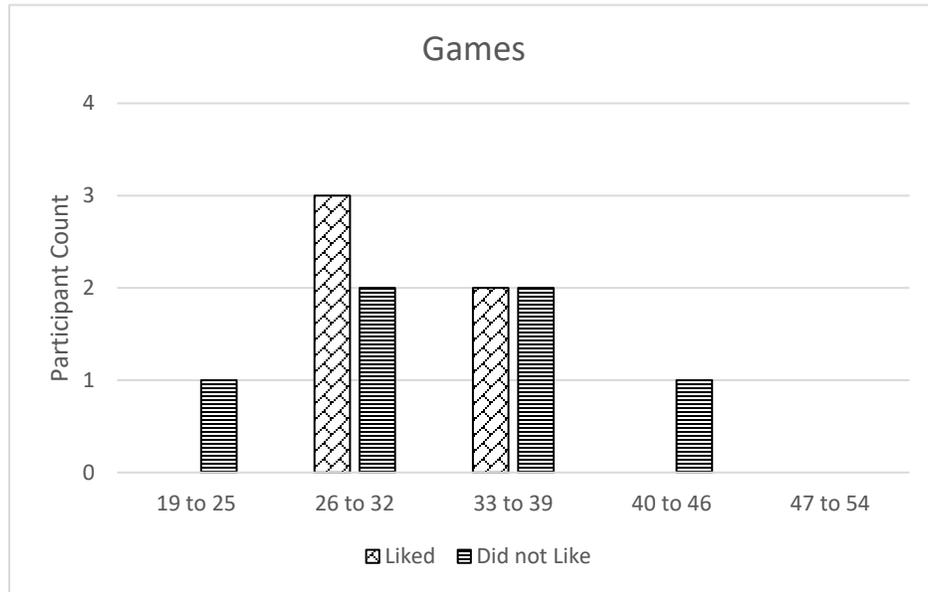


Figure 42. Dual valence comments made about games by age range