Proceedings of the Annual General Donald R. Keith Memorial Conference
West Point, New York, USA
April 29, 2021
A Regional Conference of the Society for Industrial and Systems Engineering

Modeling Knowledge Management Systems to Increase Utility in Mobile Applications

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Author Note: Perry Fulton, William Navin, and Beau Guffey are cadets at the United States Military Academy. Their responsibilities in the Corps of Cadets include Company Executive Officer, Company Commander, and Regimental Intelligence Officer, respectively. We are thankful for MAJ Stephen McCarthy, Ms. Catherine Norman, MAJ Elizabeth Lazzari, CPT Benjamin Myhren, and Mrs. Debra Dalton for their support and guidance in this project.

Abstract: The West Point mobile application is one of many information sources available for the West Point community. The application holds important information but is under-utilized as a knowledge resource due to the vast number of other information sources present for Cadets, Faculty, and Visitors. The purpose of this research is to restructure the application to become the gateway to information in the existing information network. Through mapping West Point's knowledge management system, the team developed a quantitative model to determine which information features should be present in the application and how they should be presented. Furthermore, the research team used affinity diagramming and qualitative modeling to determine which organization on West Point is best suited to continue management of the West Point mobile application. Although the research conducted is specific to West Point, the methods provide a general framework for determining which information is needed by the distinct populations.

Keywords: Knowledge Management, Quantitative Modeling, Mobile Applications

1. Introduction

The West Point Office of the Dean identified the need for a mobile application almost ten years ago. Originally, the West Point Application served as repository for cadet specific information. After its initial development, the app laid dormant remaining unused by cadets. In 2019, an effort began to revitalize the application. Since then, it grew in content and audience. Previous research teams led efforts to improve the user interface and include features that reached a broader audience. The West Point App now has many resources to offer the West Point community, but the application remains cluttered, and information is hard to find. Because of this, the application is only used by certain populations for very specific purposes.

To make the application useful for all members of the community, and to ensure the application is managed properly in the future, the research team developed a two-pronged problem statement. The primary research objective is to analyze the West Point knowledge management system to understand how the West Point App can best inform the West Point community. Once complete, the research team will set the conditions for transferring management to the ideal owner through facilitating modification of the App and determining the ideal USMA agency to permanently manage the application. To achieve these two objectives, the team must develop and analyze models of the West Point environment and owner suitability.

1.1 Initial Analysis: Risks and Limitations

Prior to data collection, the team conducted a full risk analysis to identify the potential barriers to mobile application success in academic and community settings. The greatest risk identified is in the inability to find a suitable application manager due to the relatively disparate interests and requirements of West Point populations. The three population groups on West Point were previously identified as cadets, community (staff, faculty, and family), and visitors (including parents). Like other institutions, each population group has an entity responsible for providing them with information. The application experience should be unique to each population to increase the value of use. Each responsible entity may see their role as only a piece of the information network on West Point and may be resistant to assuming the responsibility of application management

for all other populations. Even the top of the West Point hierarchy, USMA staff, may see information dissemination as an individual population responsibility.

Even though the information available in an application and the experiences for each population will be different, they should also be similar in many ways. There are some features that overlap populations presenting a unique challenge to application development. If the population experience remained siloed, it would be very difficult to integrate features that apply to all populations resulting in improper data duplication. Furthermore, because all application programming is done by a contracted company, modifications to the application structure are not done immediately. A lack of responsiveness could result in lack of user interest if the information on the application is not timely, relevant, or accurate.

2. Understand the Environment

2.1 Stakeholder Analysis

Mapping the West Point knowledge management system was a critical step towards developing the mobile application requirements for each user population. To understand where to begin, the research team conducted a detailed stakeholder analysis. The Dean's Office was our primary stakeholder because they own the app and pay the contract. Within the scope of the Dean's intent, the team identified three population categories as additional stakeholders: cadets, community, and visitors. Drawing on previous cadet and community surveys, and numerous stakeholder interviews, the team developed findings and requirements for each population. Common findings were that the information on the West Point App can be found on other platforms, and that the stakeholders value a centralized information location. To include all desired information access, the application would require a higher security level. The requirements range in significance and include content revisions, accessibility requirements, security concerns, and management desires. The most significant requirement is that for the application to meet the needs of all stakeholders, it must have the ability to secure its content through user credentials.

2.2 Background Research

To better understand the environment, the team studied successful knowledge management systems, mobile application pitfalls, and marketing strategies. Three components of a successful knowledge management systems were identified: avoid information overload and/or information isolation, develop an instructional and intuitive interface, and make the system easily accessible (Zimmermann, et al., 2000) (Edmonds & Pusch, 2002). As a component of knowledge management systems, mobile applications fail if they are not original, they do not meet user requirements, or they disregard user feedback. They may also fail if they neglect their target audience (Alfred, 2019) (Goyal, 2019). In general, a successful marketing strategy will highlight a need or knowledge gap and show the user how that need can be filled (Chaffey & Ellis-Chadwick, 2019). This strategy will also use the most effective combination of digital, visual, and verbal means to convey the application's utility.

As suspected, the West Point application fails to meet the mark as a properly marketed component of West Point's larger knowledge management system. However, by fusing stakeholder analysis and background research, an achievable end state can be planned. A successful application will achieve two primary functions: provide relevant content and promote application use. Within each function are objectives and measures of success, which are visualized in Figure 1.

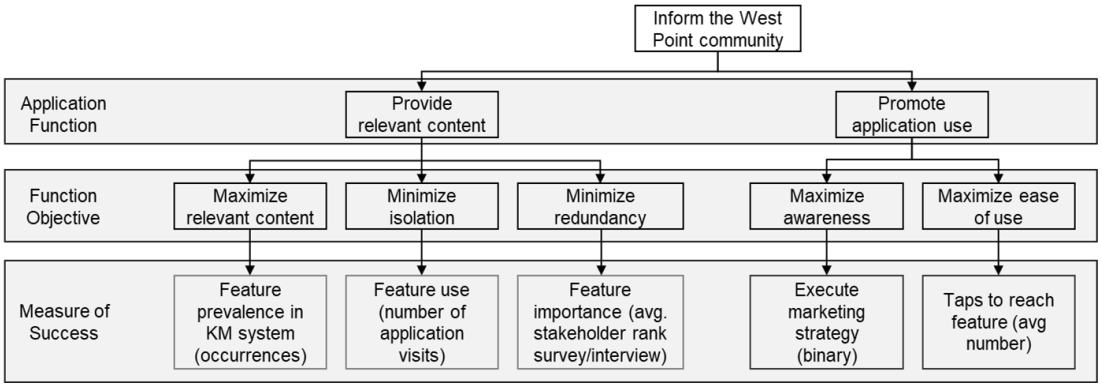

Figure 1. Functional Hierarchy of Project Goals

Because the primary objective is to improve application utility for each user population, the function "provide relevant content" becomes the focus for the knowledge management mapping process. Its measures of success (outlined in green in the figure above) then become the focus of data collection and model development. "Promote application use" will be achieved later in the process. Maximize ease of use (highlighted in red) will be measured during the data analysis and implementation stage while maximize awareness will be achieved when modeling ownership transfer.

2.3 Data Collection

To quantify feature prevalence, feature use, and feature importance the team surveyed each information sub-system including the West Point application, westpoint.edu, SharePoint, O365 and Microsoft Teams, academic content management systems, email, and academy administrative platforms. 102 unique features were discovered across the entire knowledge management system ranging from the cadet honor program to the installation phone directory. The team then assessed each of these features according to their relevance to the cadet, community, and visitor user populations.

Feature prevalence, the measurement of content relevance, became the count of times each feature was found across all platforms. Feature use, the measurement of information isolation in the application, is the number of times a feature was accessed on the West Point application in the last year. Finally, feature importance was determined through stakeholder feedback for all 102 features. Two sets of data were used for this measure of success: historical stakeholder survey of the West Point community (Aloma, et. al, 2019) and subject matter expert interviews. The data collection process is depicted below in Figure 2.

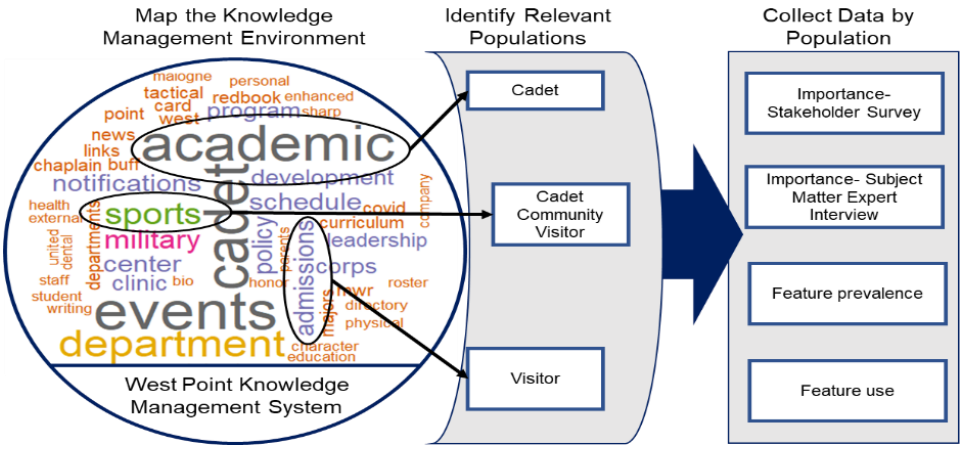

Figure 2. Feature Importance and Knowledge Gain

3. Model Development

Following data collection, the team designed a quantitative model to identify which specific features should be included in the application. The goal of this model is to define the functionality that each stakeholder requires. To minimize redundancy and maximize ease of use within the application, features relevant to all populations were identified. Observing that many features are relevant to all populations, the model was constructed to consider an "everyone" population in addition to cadets, community, and visitors.

3.1 Model Formulation

The team used an additive value modeling process to determine the relative value for each feature within each population category (Oxford University Press). This process finds a value score by multiplying the normalized value of a measure of success by the "weight" or importance of that measure. Because the same data source is used for each population, the weight of each measure differed by population according to stakeholder analysis. For instance, because the stakeholder

survey specifically targeted families on West Point, this data source achieved a higher weight for features in the community population model.

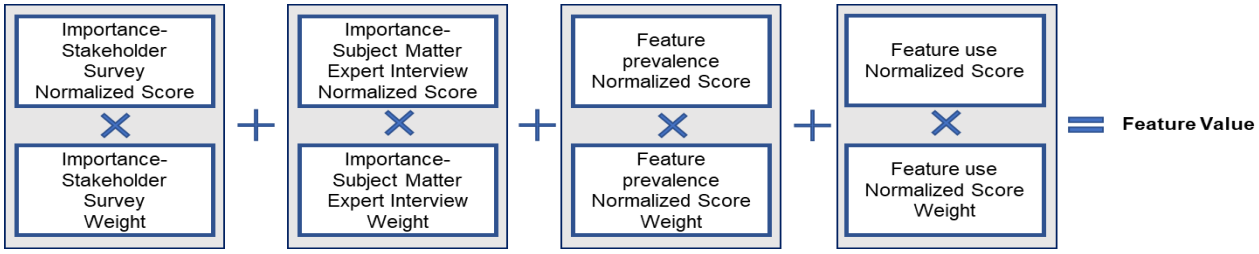

Figure 3. Feature Value Calculation Model

To normalize scores within each data source, an empirical Cumulative Distribution Function (CDF) was developed for each measure of success. Normalized scores are determined by finding the cumulative probability given the raw data value. This process was replicated for each feature within each population yielding a score from 0-4 for each feature. This process is illustrated in Figure 3.

4. Model Analysis and Implementation

4.1 Model Conclusions

The previous modeling process directly addressed maximizing relevant content, minimizing isolation, and minimizing redundancy. Incorporating the output of most important features in solution design will ensure that the primary function, provide relevant content, is met. However, the second function, promote application use, must also be addressed. In analyzing top features, the team addressed the first objective of "promote application use", which was maximizing ease of use. To make the application more intuitive and to reduce the number of taps required to access a feature, the team used affinity diagramming to categorize each feature. The top 30 features, which statistically were of relevant importance, were examined for each population and logically grouped into categories for information. To visualize the importance of categories, each one was assigned the score of its highest ranked assigned feature. Figure 4 shows a breakdown of the top-scored features by population.

Figure 4. Model Analysis. Population Relevant Categories

4.2 Recommended Design

In considering model output and analysis in solution design, the team encountered challenges identified through initial risk analysis. Although some categories were found in all populations, the features within the categories have minor differences. The five features that exist in the cadet "stay updated" category are not the same five features that exist in the

visitor "stay updated" category. To minimize information overload through superfluous information, the team ruled out an "everyone" population and omitted the original structural feature of a bottom banner that had information for all populations. The team iterated through solution designs with the development company, updating the designs to accommodate the development company's capabilities. The final design that met all requirements (Figure 5) is an application experience that allows you to select your population first. It then displays all categories and subsequent features for that population. Within each category and population, these features can be turned on or off to present the unique experiences needed. This design produces the highest value as it reduces effort for developers and administrators while also minimizing redundancy in information.

Figure 5. Recommended Application Interface

5. Transferring Ownership

5.1 Concept

The last objective within the application's functional hierarchy is to maximize awareness through execution of a targeted marketing strategy. This component is the most critical to an application's success as even a perfectly structured and suitable application will have no value if the populations are unaware of its existence. So far, the team has not applied a marketing strategy as the changes to the application interface are still being made. However, this has led to a lack of awareness of the App and therefore a decreased value to potential future owners. The future owner would be advised to implement the recommended marketing strategy. In deciding who should maintain responsibilities for the application, the team designed a screening and scoring process that identified potential application managers and analyzed them according to weighted screening criteria. The screening criteria in order of importance are level of influence, desire, effort, organizational capability, and technical capacity.

5.2 Analysis of Alternatives and Recommendation

The original list of potential app managers included the West Point information office (CIO/G6), long-range planning and strategic efforts office (G5), public affairs (PAO), installation command (Garrison), Brigade Tactical Department (BTD), cadets, and the Office of the Dean. These organizations were assessed under the following considerations in order of importance: desire, level of influence, effort, organizational capabilities, and technological capacity.

To reach the ideal candidate, the team used an initial screen followed by a scoring process shown in Figure 6. The initial filter screened alternatives based off level of influence; those with little strategic influence were removed from consideration. It is critical for the manager to have reach across the West Point information environment so that accurate information can be collected and synthesized properly. The initial screen reduced the list of potential managers to four: CIO/G6, PAO, G5, and cadets. The scoring process used a weighted scoring model to find the ideal candidate according to the remaining four screening criteria. Based on the determined criteria and weights, the ideal application manager is the public affairs office.

ISBN: 97819384962-0-2

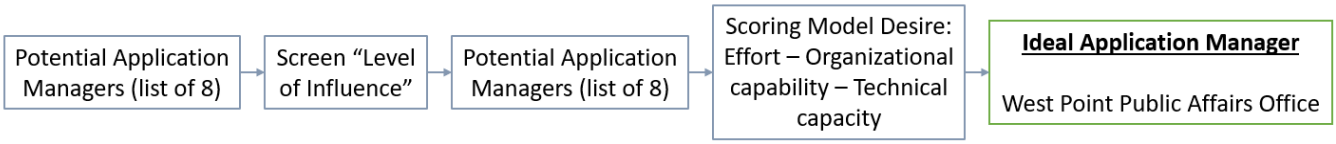

Figure 6. Ideal Application Manager Selection Process

6. Conclusion

The new design of the West Point app has great potential to serve as a reliable and effective source of information. Redundancy and clutter have been reduced by separating and prioritizing information based on the population category the user falls within. App users will now have fast access to information that is directly related to them without having to search through a mass of other options. In addition, through a subjective modeling process, the team has identified the West Point Public Affairs Office (PAO) as the most suitable app manager going forward. Based on their assessed level of effort and desire, organizational and technological capacities, and level of influence, the team believes the app will be most effectively managed by the PAO. It now falls on the Department of the Dean to delegate the official responsibility based off the team's recommendation. An effective marketing strategy executed by the right management organization will encourage use of this vital resource. Although the research conducted is specific to West Point systems, the methods presented provide a general framework for determining which information features are most needed by distinct populations in large communities.

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