Crosscutting by design to maximize operational impact

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Abstract — The United States Department of Homeland Security (DHS) Science and Technology Directorate (S&T) strives to address capability gaps across multiple components. To maximize technology and training research and development investments, S&T works closely with industry partners and component stakeholders to develop interoperable solutions that can be transitioned to multiple components – meeting the crosscutting need as well as component-specific needs. Gathering stakeholder needs, maintaining stakeholder engagement, balancing contradictory needs, avoiding redundant investments and securing solution transitions across multiple components demands use of processes on the part of DHS program managers and industry partners. The current presentation outlines an S&T approach for research and development that includes transition planning that incorporates early identification and needs gathering from component stakeholders and continues engagement through to operational implementation to ensure the solution provided meets or exceeds component expectations, and can be directly integrated for desired use –be it process, selection, training, or operational solution.

1 Introduction

The United States Department of Homeland Security (DHS) is comprised of a broad range of components with both distributed and shared roles and responsibilities while facing diverse risks, need, and priorities. Science and Technology Directorate (S&T) strives to address capability gaps across a range of components by balancing the diverse needs and priorities, while focusing on shared interests and responsibilities [1]. To maximize investments in technology and training research and development, S&T works closely with industry partners and component stakeholders to develop interoperable solutions that can be transitioned to multiple components –meeting the crosscutting need as well as component-specific needs.

2 Approach

Gathering stakeholder needs, maintaining engagement, balancing competing or contradictory needs, and securing transitions demands the use of repeatable processes on the part of DHS program managers and industry partners.

2.1 Strategic and transparent engagement

DHS S&T has established the Office of Innovation and Collaboration to act as a conduit to a broad range of stakeholders including DHS components, other government agencies, industry, foreign partners, and academia. Through continual engagement efforts, DHS S&T has been able to develop an in-depth crosscutting understanding of high priority capability needs, gaps, and operation requirements with potential to impact multiple stakeholders. An additional benefit is the potential for shared funding with other agencies and/or foreign partners to maximize return on investment for each partner.

2.2 Solution development framework

DHS S&T utilizes a technical approach to crosscutting solution development and transition that relies heavily on customer and stakeholder interaction. As demonstrated in Figure 1, the DHS S&T technical approach begins with engaging end users across multiple components to capture user needs through a process of cognitive walkthroughs, focus groups, attending training sessions, reviewing existing training materials, and conducting stakeholder interviews.
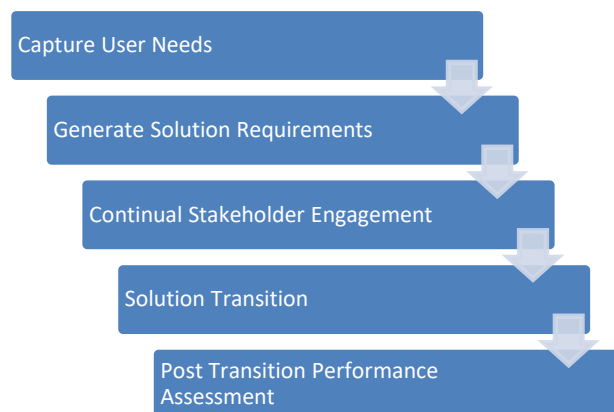

Fig. 1. DHS S&T Solution Development Framework

User needs are then leveraged to generate solution requirements through identification of operational needs and capability gaps with consensus on high priority requirements across DHS components. As solutions are developed, stakeholder engagement is continued through an iterative design process. Project milestones such as requirements, wireframes, prototypes, and scripts are all validated through continual input from stakeholders. A direct result of continual stakeholder input is a rapid and fluid transition of the solution to DHS components. As each solution is transitioned, DHS S&T conducts a Post

Transition Performance Assessment (PTPA) to determine the impacts of the solution on end users. Metrics for the PTPA are gathered at the start of each program to establish a baseline. As project milestones are achieved, PTPA metrics are re-evaluated to assure relevance to an often changing operational environment. Finally, PTPA metrics are again gathered after program transition to assess changes in operational effectiveness and/or efficiency. For each PTPA, a test plan is created and validated with Subject Matter Experts (SMEs) from the participating DHS components. As the PTPA is conducted, continual communication with component SMEs is maintained to assure that the program follows identified high-level schedules, scope of events, and estimated testing resources.

2.3 Solution development example

The DHS S&T Solution Development Framework was generated/evaluated through development and implementation of solutions ranging from bio-assessment of stress in training to the use of eye-tracking to provide training feedback, to heuristic evaluations of interface designs. The current presentation focuses on one specific example to provide a concrete understanding of the framework.

The DHS S&T strategic and transparent engagement process identified a capability need for the United States Border Patrol (USBP). The USBP mission relies on the capability of U.S. Border Patrol Agents (BPAs) to track and apprehend aliens and smugglers [2], known as signcutting. A key challenge is that the signcutting tasks are highly dependent on implicit perceptual skills that are not easily or effectively conveyed by Expert Trackers [3]. There was a need to generate signcutting training materials based on cognitive knowledge elicitation to supplement existing materials with cues and techniques utilized by experts that are difficult to obtain through traditional instructional design methodologies.

2.3.1 Capture User Needs

A key component of developing solutions that are crosscutting is to engage multiple components early in the process. The DHS S&T engagement team leveraged existing and new contacts to identify a compatible need in a separate DHS component. The Federal Law Enforcement Training Centers (FLETC) instruct Federal, State, Local, and Tribal law enforcement officers in signcutting techniques to supports missions varying from search and rescue to crime scene analysis. By combining the needs of the individual components, DHS S&T could maximize the impact of a strategic investment in additional training materials.

The solution development team conducted a user needs analysis that included

1. A review of existing training materials from USBP and FLETC
2. Direct observation of training for USBP and FLETC
3. Observations of operational signcutting tasks at 3 border patrol sectors
4. Cognitive knowledge elicitation interviews with signcutting experts

2.3.2 Generate Solution Requirements

Based on captured user needs, the DHS S&T solution development team, as well as SMEs from USBP and FLETC, generated a set of training requirements including composing learning objectives and defining appropriate training content platforms. Both components agreed to web enabled training content to convey basic concepts and a 3D video to convey advanced concepts.

2.3.3 Continual Stakeholder Engagement

Despite the numerous solution commonalities across the USBP and FLETC, conflicting training needs at the specific content level were rapidly identified in the capture user needs phase of development. Bi-weekly meetings including stakeholders across both components were established to provide SMEs with a platform to openly discuss and agree upon training solutions that would benefit both organizations. Discussions were also used to determine the amount of training materials that could be produced within scope, time, and budget. At each project milestone (e.g., gap analysis, learning objective definition, storyboarding, script writing) materials were presented to and agreed upon by all stakeholders at the bi-weekly meetings.

2.3.3 Solution Transition

A direct result of the continual stakeholder engagement was a solution transition that maximized operational impact to include all newly hired USBP Agents as well as Federal, State, Local, and Tribal law enforcement officers across the United States. No stakeholders requested any changes to the provided solution at transition because input had already been integrated at previous milestones.

2.3.3 Post Transition Performance Assessment

Post Transition Performance Assessment is critical to evaluating current and future S&T investments and measuring the impact of those investments. Without knowing the why, when, where, and how much of an impact a transitioned solution has on operations, it is difficult to assess the added value of a new technology, tool, policy, method or knowledge product and if further investments should be made in that candidate solution/research topic/process improvement in annual resource planning and budget allocation.

As a first step toward a full PTPA, a pilot study was conducted to determine the training impacts of the web enabled signcutting training and video. USBP Agent Trainees (BPATs) using web enabled signcutting with video training demonstrated equivalent pre-post

improvements in knowledge and comprehension as BPATs using instructor-led training. In addition, BPATs using web enabled signcutting with video training demonstrated significantly higher scores (63% higher) in applications, analysis, and synthesis compared to BPATs using instructor-led. Finally, BPATs indicated statistically similar ratings of perceptions of learning across web enabled with video and instructor-led training in a post-training survey. Based on the results of the pilot study, a full Post Transition Performance Assessment will be conducted.

3 Findings

It is critical to have early iterative structured engagements with stakeholders and end users across multiple components to capture the broadest range of needs and gain consensus on requirements that 1) are within scope and budget and ultimately achievable in the desired timeframe 2) cover the maximum number of needs across components. The process begins with securing end user engagement and capturing needs through the use of cognitive walk-throughs, focus groups, attending training sessions, reviewing training materials and standard operating procedures and conducting interviews. The next stage is to identify the operational needs and capability gaps with consensus on high priority requirements across components. Iterative design is a key component of the process. Identifying tasks, critical decisions, information requirements, dependencies and data sources enables development of wire frames, prototypes, etc. that then need to be validated with stakeholders and end users at each stage of development. Incorporating continual input for incremental changes from stakeholders mirroring an agile design process ensures that the final solution will meet identified needs and have a higher probability of successfully transitioning to operational implementation. After transitioning the final solution, a post transition performance assessment is conducted to assess operational impact, answering "how much has the S&T investment impacted operational outcomes?"

4 Conclusions

1. Involvement from stakeholders and end users from multiple components must begin at the start of projects to maximize benefits of the process.
2. Maintaining stakeholder and end user engagement is a challenge that requires constant attention and patience.
3. Iterative design with stakeholder and end user involvement reduces risks/surprises/unknowns and reduces last minute change requests as design is finalized and increases the probability that the design will be acceptable to the customer and/or end user and successfully transition to operations.
4. Balancing the crosscutting need with component-specific needs often requires obtaining consensus across components to prioritize requirements.
5. Post transition performance assessments results in wider solution adoption across multiple components, maximizing the impact of the investment.

References

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Author/Speaker Biographies

Jesse D. Flint is a Senior Research Associate for Design Interactive, Inc., with over a decade of experience in cognitive psychology research. Mr. Flint's work focuses on human factors research and technology capability design for Department of Homeland Security (DHS) components such as the Federal Law Enforcement Training Centers (FLETC).

Darren P. Wilson serves as a Scientific and Technical Advisor within the U.S. Department of Homeland Security Headquarter's Science and Technology Directorate. He provides advice and counsel across the Directorate and Department to optimize operational efficiency and effectiveness through implementation of methods, tools and technologies to maximize human performance.