Prototyping a Modernized Navy Personnel Qualification Standard (PQS) System

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Overview

- Navy’s **Personnel Qualification Standards (PQS)** system is ripe for modernization
  - There is a need for standardized and centralized learning material
    - Rather than ad-hoc or distributed across locations
  - Sailors expect digital systems
    - Rather than paper-based and manually coordinated
  - Modern science of learning tools could monitor qualifications
    - Sailor readiness and skill progression
    - Effectiveness of all content over time

- What would a modernized digital PQS look like?
Vendor Perspective

- Demonstrate “art of the possible” with an **agile, six-week development effort** to depict and win buy-in on what a digital PQS system would look like.
Ready Relevant Learning (RRL)

• Today, RRL is fundamentally changing how Sailors learn
  – All aspects of RRL are focused on making a Sailor an optimal performer

• Learning Continuum: how could PQS provide the right training at the right time?
  – Shorten the time throughout a career between training and on-the-job need

• Modern Delivery at Point of Need: How can PQS leverage digital technology?
  – Incorporate modern capabilities like linked systems, authoritative data

• Integrated Content Development: How do we ensure training is valid & relevant?
  – Manage change and mitigate obsolescence in an evolving environment
Prototype Design Goals

• Ensure safety and mission completion never falter
  – Must earn trust in the digital system

• Minimize human-system disruption
  – Will continue 50 years of tradition and culture

• Minimize disruption in Fleet workflows
  – Keep clear correspondence with existing paper process

• Preserve existing Qualifier-Sailor interactions
  – Maintain or increase accountability within the system
Rapid Development

• Six week total development cycle
  – Agile engineering approaches in a DoD setting

• First week
  – Kickoff and domain selection: Damage Control
  – Three full days of face to face design meetings between stakeholders and vendor engineers

• Weekly engineering sprints
  – Weekly status updates to all stakeholders
  – Weekly remote demos of current functionality

• Fast feedback from subject-matter experts
  – Quick and collaborative software changes
  – Continuous learning and improving the product
Developed Features

• Learning Continuum Display
• Learning Continuum Portal
• Learning Resources
• Qualifier Interface
• xAPI Integration
• Backend / Learning Data Stack
• Web Architecture
Learning Continuum Display

- Present learning material on a continuum
  - Sailors see the connection to their Naval careers

- Track and guide Sailors at all stages of career life cycle:
  - Time
    - Accession, First Sea Tour, Shore Tour, Second Sea Tour, and Beyond
  - Competencies
    - Technical, Professional, and Leadership development
Learning Continuum Portal

- Single access entry into learning topics and resources
- Research character can support long-term relationship
- In the future, will facilitate directing sailors through myriad of training resources and suggest personalized “next steps” for learning
Learning Resources

- Repository of validated learning material supplied at the point of need
- Supports multiple media formats including future augmented reality
- Links to resources embedded directly in the question itself
Qualifier Interface

- Follows Sailor progress as evidence of readiness for assessment
- Dashboard of progress and open signoff requests
- Qualify students on particular PQS topics
- PQS section-level signoffs
xAPI

• Track fine-grained student-content interactions
  – Pages viewed in a PDF
  – Percentage of video watched
  – Content completed, how recently and how quickly
  – Individual answers correct / incorrect in practice quizzes

• Can gather longitudinal statistics and enable inferences
  – Content view count indicating utility to Sailors
  – Usage in context indicating use case (reference, test prep, introductory)
  – Change over time indicating possible obsolescence of content
Implemented Architecture

- Moves Science of Learning concepts into operational use
- Leverages existing DoD and Naval research investments
Backend / Learning Data Stack

- **Learning Record Store (LRS)**
  - Serves as an xAPI data warehouse
  - Stores evidence about learners, resources, and qualifications

- **Competency framework**
  - Defines and relates job tasks, competencies, and underlying knowledge or skills

- **Learner profile**
  - In our use, a long-term record of inferences about student performance and qualifications

- **Activity index**
  - Maps every Naval watch station to required learning material and PQS qualifications
Web Architecture

• RESTful web services back end written in Java (JAX-RS)
  – Can support multiple user interfaces if needed

• User interface / front end written in Vue.js
  – Can run on laptop or mobile devices

• Data storage with Postgres DB for logins, user roles, learning ontologies
  – LRS for activity records, qualifications

• Can embed and deliver a variety of content with xAPI integration:
  – Movies (HTML 5 video player)
  – PDF (JS-based PDF renderer)
  – Multiple-choice quizzes
  – Links to launch external learning activities
Technical Challenges

• Deployed hardware must be compliant with DoD IA guidelines
  – NIST SP-800
  – DISA’s STIG (Security Technical Implementation Guides)

• Interoperability between data silos – even within the Navy, there are challenges to collecting and centralizing information
  – Challenges collecting training material
  – Legacy training exists in Adobe Flash, must be rewritten for modern Information Assurance

• DoD needs shared standards for xAPI usage
  – Common challenges: Unique identifiers not aligning, verb mismatches, inconsistent triggers, different ways of referencing content (ID, URL, etc), link data versus catalogs for vocabulary
Lessons Learned

• Tight communication loop between vendor and DoD representatives
  – DoD stakeholders, funders, leadership
  – Subject-matter experts and end users

• Software solutions should be agnostic to hardware choices
  – Responsive UI design to flexibly meet deployment constraints
  – Visual clarity for use on multiple devices

• Open challenges in integrating LRS solutions in real-time web systems
  – Existing SOTA LRS solutions have slow (> 100 ms) response times for retrieval
  – Cannot process inside the user interaction timeframe
  – Local caching layer, offline processing, and process batching needed
Conclusions

• Agile development in a DoD setting

• Working prototype with IA compliance enables demonstration and feedback

• xAPI enabled

• Supports Ready Relevant Learning to help every Sailor perform at peak
Questions?

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