

# U.S. Navy STEM-Mentor Project at ICT, USC

## Executive Summary

**Core Idea:** To improve pre-college students' understanding and interest in Navy-relevant STEM careers, by building a tablet-based app that emulates one-on-one conversations with STEM professionals, so that each student can participate in a natural (voice-input) conversation with virtual humans whose answers are each drawn interviews with a real-life STEM professional. An intelligent guide (Pal) will coordinate their interactions with these virtual conversations, helping students learn about different STEM fields, career experiences, and learning/job activities.

**Problem Statement:** Students' awareness of career opportunities tends to be disproportionately influenced by their social circles and media portrayals of careers. Students, particularly those from historically underrepresented populations, often lack access to role models in STEM careers and knowledge about different STEM careers. In an ideal world, guidance counselors and teachers could organize events where students could meet STEM role models and try out examples of career tasks. However, events such as career fairs do not scale well: professionals have limited time, effective mentors are not readily available in all fields, and those who volunteer will tend to be connected to the school (e.g., parents, friends of staff). As such, the students who need these types of experiences the most will be the least likely to receive them. The result is that students' understanding about what professionals in STEM fields do on a day-to-day basis, what education is needed, and even what STEM fields exist is minimal (Bieber et al., 2005). Moreover, since in-person interactions are based on availability of role models rather than expected demand (e.g., projected Navy or U.S. economy needs) for jobs, students may form career goals for stagnant fields rather than growing fields. Together, these barriers prevent many students from entering STEM, since students' opportunities are impacted by their career goals as early as high school (Wang, 2013). These systemic problems have ripple effects that reduce the STEM skills for recruits.

**Proposed Solution:** ICT proposes to create a scalable tablet-based app that gives students the opportunity to interact with a variety of STEM professionals from different fields and backgrounds. We plan to do this by building conversational virtual agents that emulate a question-and-answer session between students and STEM professionals who have current or prior Navy ties and are engaging, enthusiastic, and effective mentors. These interactions will allow students to have a life-like informational interview with virtual agent whose responses are directly drawn from an interview with a real-life professional in that field. At least in real-life contexts, such interactions are known to be effective for increasing motivation, engagement, and career self-efficacy (Herman, 2010). The proposed research will design virtual human agents in the same role and evaluate their effectiveness. These agents will be designed using USC-ICT Virtual Humans (Swartout et al., 2006), which support life-like agents with realistic facial expressions and gestures. While such agents have previously been used as virtual coaches, it has not yet been attempted to model career counseling agents on individual STEM professionals (a key innovation of this project). To help ground students' understanding of STEM fields, each agent will be complemented with a variety of resources. These resources will include: example tasks for the student to attempt (e.g., diagnosing a circuit fault in electronics), videos of on-the-job performance, example resumes from that field, and statistics about salaries and growth in demand. These resources will be coordinated and personalized to each learner by using the Personal Assistant for Life-Long Learning, an intelligent guide to learning resources (PAL3; ONR W911NF-04-D-0005). By building onto the PAL3 platform for Navy life-long learning, Mentor-Pal should also be able to rapidly synchronize with emerging STEM needs for the Navy.

**Measures of Success:** The impact of this intervention on students would be evaluated through a series of studies with high-school students, which are expected to improve three key outcomes:

1. Maturity and decidedness of plans toward specific STEM careers,
2. Motivation toward STEM careers, and
3. Self-efficacy with respect to STEM careers.

In Year 1 and into Year 2, small-scale trials for Navy-relevant STEM domains (starting with Electronic Technicians) would be conducted at K-12 sites in Southern California close to the researchers, to enable collection of observational and talk-aloud feedback from students. Assuming strong efficacy in small-scale trials, Year 2 and Year 3 would focus on increasing the number of STEM fields represented (i.e., additional mentors) and on increasing the number of users by transitioning to a broader set of educational institutions. The goal for Y3 is to support testing and transition to encouraging sustainable use by institutions invested in STEM learning (e.g., the Naval Academy Alumni Mentoring Program, the STEM internship programs such as those at the Naval Postgraduate School, and NROTC use). Details on the transition plan are noted later in this full proposal.