

## Writing High Quality Code to Facilitate Project Management

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**Author Note:** Paula Huang is a graduating senior major in computer engineering. She worked as an undergraduate research fellow sponsored by Booz Allen Hamilton Inc. in 2015 under the guidance of Dr. Gang Qu, Mr. Ganesh Alhat, Ms. Emily Leung, and Mr. Bill Olsen. The goal of this project is to explore the feasibility of integrating static code analysis into entry level programming courses such that students can learn the concept of writing high quality code for project management.

**Abstract:** Software development and maintenance plays a vital role in systems engineering. Through numerous projects on both military and civilian systems, Booz Allen Hamilton (BAH) observes the growing gap between the need of high quality code for software delivery and software engineer's lack of skills in writing high quality codes. Our current education system takes most of the blame as software engineering curriculum focuses on functional correctness, then performance optimization in terms of run-time and resource (memory, power, etc). Project documentation is normally an afterthought and remains at the level of comments. Other important concepts for project management such as transferability, changeability, security, efficiency, and robustness are never mentioned. This problem becomes even worse with the national trend of pushing programming into K-12 system (e.g. the popular LEGO Mindstorms education set, LEGO programming competitions, and Java/Python programming courses offered in middle schools and high schools). As the software system becomes more and more complicated, it becomes vital to teach software engineer the importance to reduce risks, prevent vulnerabilities, and eliminate performance/security issues during the software system development.

Industry has to develop automated code analysis tools to help project managers to handle tens of thousands lines of functional correct low quality codes. Source Code Analysis (SCA) is empirically proven to be one of the most effective pre-test defect prevention techniques, increasing quality, and reducing downstream rework. Project teams require more advanced methods to address defects, vulnerabilities, and sub-standard coding practices to ensure the highest levels of structural quality, maintainability, and security before application deployment. In order to support this, project teams needed an automated and repeatable way to measure and improve the application software quality of multi-platform, multi-language, and multi-sourced applications. Companies such as BAH has to train their employees to learn these code analysis tools and more importantly, how to identify code irregularities and vulnerabilities early in the development lifecycle and reduce risk of systems delivery to their clients. In this project, we study several available code analysis tools (including CAST application intelligence platform, an open-source tool called Sonarqube, and Codility) on the feasibility, challenges, and benefits of introducing them into college students' first programming course. As a result, we have produced a series of video clips to teach students the basic concepts of project management, to guide them on how to install such code analysis software, and to give them some general rules on writing high quality code through examples and demonstration. These clips are currently used by BAH's SCA team internally for new interns and employee training purpose. The ongoing follow-up project includes a field experiment of lecturing these concepts in Dr. Qu's freshman programming class, making the training video clips available to the students, and re-designing course projects to focus on high quality code writing.

*Keywords:* code analysis, code quality, project management, education.