

Work in Progress – e-TAT: Online Tool for Teamwork and “Soft Skills” Assessment in Software Engineering Education

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Abstract - Assessment of teamwork and “soft skills” in the context of software engineering has been recognized as very challenging. Furthermore, there are very few software tools that allow efficient applications of these assessments. San Francisco State University, working jointly with University of Applied Sciences, Fulda, Germany, and Florida Atlantic University, has developed a novel set of composite metrics for teamwork and soft skills assessment, which have been applied manually and with low efficiency in our jointly run SE classes. In order to apply this composite assessment method more efficiently and effectively, we have embarked upon the design of an Open Source Web-based electronic Teamwork Assessment Tool, *e-TAT*. In this paper we present the goals, design objectives and the status of the design and development of *e-TAT*.

Index Terms – Assessment, teamwork, soft skills, tools, software engineering.

INTRODUCTION AND BACKGROUND

Educating students on the practical principles of Software Engineering (SE) is critically important for the computing industry and for students’ careers. This is especially challenging as it relates to *teamwork and soft skills* such as organization, SE processes, project management, teamwork ethics and practices, collaborative and communication skills and practices, as well as the ability to effectively use the required tools for collaborative software (SW) development. Recent principles and recommendations for SE education presented by the IEEE [1] and ACM [2] point to a critical need to combine the typical computer science foundational learning components (often called “hard skills”) with these engineering, organizational, social, collaborative, teamwork, communication and project based skills (the “soft skills”). The assessment of these skills poses significant challenges, both in terms of how it is done, as well as how to make this assessment methodology efficient, effective and transferable. The assessment of teaching efficacy of some aspects of teamwork and soft skills via surveys and instructors’ observations is reported in [3], [4], [5], [6], [7], [8], [9], [14], [15], and [16]. No statistics of SE development and

collaborative tool usage have been used except in [16], and no integrated SW tools for assessment have been reported.

San Francisco State University (SFSU) has been teaching a software engineering (SE) course for several years jointly with University of Applied Sciences, Fulda, Germany (Fulda), and Florida Atlantic University (FAU), where student teams develop a complete SW project working in local or global (multiple schools) teams of 4-6 students per team, in an environment designed to emulate a real-life SW development environment [10], [11], [12], [13]. Students in all three schools implement the same team project in five well-defined milestones using *collaborative* and *SW development* tools. As part of the course improvement and grading, we previously developed and manually performed a novel composite assessment method related to teamwork and soft skills, which we apply during our SE classes [12]. The learning outcomes for teamwork and soft skills which we assess for students and for the teams are: 1) learned knowledge of teamwork and soft skills concepts, best practices and “theory”; 2) ability of students to effectively apply teamwork and soft skills in a team project; and 3) ability of students to effectively use the tools for collaborative SW development in an actual team project. Learning outcome 1) is assessed by target questions in a classical final exam (a standard assessment method) and is not the major focus of this paper. The novelty of our assessment method relates to learning outcomes 2) and 3), which measure *actually applied and exhibited* teamwork and soft skills. In addition to the quality of the final project (e.g. functionality, correctness, user interface, architecture, documentation), for outcome 2), we use instructors’ analysis and observations of team behavior, and the actual application of teamwork and soft skills principles and best practices, delivery of project items on time, the number of teamwork problems and escalations, as well as weekly student survey responses related to effort expended and perceived impediments in their teamwork. For outcome 3) we measure the level of students’ tool usage for collaboration and SW development (e-mail, discussion forums, posts to repositories, issue trackers etc). These measurements are then the basis upon which instructors make final assessment of how well the students achieve the desired learning

outcomes. The key efficiency impediments to this assessment method were: the collection of the statistics and surveys, the tracking of the instructor's observations, and finally the lack of an integrated method of storing, retrieving and reporting these basic metrics. These factors, as well as our desire to share the assessment methods and data, motivated us to create the SW assessment tool e-TAT.

E-TAT REQUIREMENTS AND DESIGN GOALS

e-TAT is envisioned to be an easy to use open source tool, applied in conjunction with other SW collaboration and development tools. e-TAT collects, stores and presents the three key complementary components and measurements used for our assessment: a) objective and automated measurements of participants' usage of communication and SE development tools (Google Code and Google Groups in the first version), b) subjective self-assessments via online surveys that focus on perceived teamwork efficacy and efforts; and c) instructors' annotations and observations on teamwork, students' application of SE soft skills, quality of deliverables etc. More specifically, this includes:

- Collaborative tool usage statistics, such as number of postings to group mailing lists and forums, and commits to code repositories, which serve to indicate the level of teamwork activity.
- Surveys administered periodically (e.g. weekly) allowing students to subjectively self-assess: factors that impede/enable progress, such as time zone differences, cultural differences among team members and lack of 'in-person' contact; the amount of time spent engaged in various project related activities such as meetings or producing deliverables; and the self-perceived effectiveness of teamwork and group interaction.
- Instructors' logged annotations (observations) of the teamwork activities (e.g. how the groups dealt with feedback, count of teamwork violations where team leaders or instructors had to get involved, and team meeting attendance), student performance and quality of deliverables etc.

Instructors can request a variety of reports from e-TAT at any time during the SE class, thus using it for both the final assessment, as well as for ongoing monitoring of students' involvement

Initially the SW collaboration and development tools used in conjunction with e-TAT will be limited to only one set (e.g. from Google collaborative tools, Google Code and Google Groups since they provide ATOM feeds to access its usage). e-TAT will use the ATOM feeds to read and update data within its own database. This will be performed at regular intervals, as well as upon request for "synchronization" by the user. Proper data accumulation for usage statistics will be done using time stamps associated with each usage data item. Since e-TAT is open source it will allow future enhancement by users to accommodate other tools and functions.

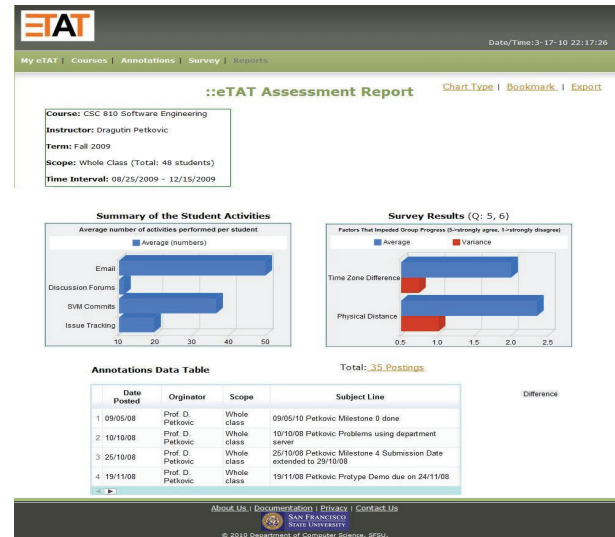


FIGURE 2
EXAMPLE OF THE UI DESIGN FOR E-TAT GENERATED ASSESSMENT REPORT

E-TAT STATUS AND EVALUATION

e-TAT is being designed using modern SE practices by a team of instructors and graduate students at SFSU, with reviews and input from Fulda and FAU. SE methods include User Centered Design methodology, Agile/SCRUM and iterative development. The first envisioned goal is to complete, deploy and evaluate e-TAT in joint SE classes at SFSU, FAU and Fulda which will include over 100 students and three instructors each year. Upon successful testing e-TAT will be available as Open Source tool.

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