THE ROLE OF MEASUREMENT IN ISEEs

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ABSTRACT: The main objective of software engineering is to support the development of quality software in a cost-effective way. It is long agreed within the software engineering community that more effective software processes and more effective automated support via integrated software engineering environments (ISEEs) are needed. The TAME ISEE project at the University of Maryland is based on the assumption that there is a basically experimental nature to software development. As such we need to treat software development projects as experiments from which we can learn and improve the way in which we develop software. Learning and improvement require a development model which not only addresses the construction of software products, but also the planning of the construction processes, the control of the construction processes, and the necessary learning from each project in order to do it better next time. I present the improvement-oriented software development model which has been developed as part of the TAME project, and suggest that future ISEEs should be instantiations of this model. I develop a scheme for classifying ISEEs and survey five current ISEE research projects. Finally, I list several (mainly measurement-oriented) ISEE requirements and demonstrate how these are being addressed in our first prototype TAME system.

KEYWORDS: integrated software engineering environments (ISEEs); software development process model; planning; construction; analysis; control; learning; improvement; goal-oriented measurement; TAME project; TAME system.

1. INTRODUCTION

The main objective of software engineering is to support the development (and maintenance) of quality software in a cost-effective way. It is long agreed within the software engineering community that more effective software processes and more effective automated support via software engineering environments (SEEs) are needed (see [21]).
It is, however, not agreed on how such process models and supporting SEEs should look like.

There is a basically experimental nature to software development. As such we need to treat software development projects as experiments from which we can learn and improve the way in which we develop software. We have been slow in building descriptive models of software development processes. As a consequence, we are still weak in building prescriptive models during the planning stage of software projects. Measurement and analysis have only recently become mechanisms for planning, controlling, learning and improving software processes and products.

In the TAME (Tailoring A Measurement Environment) project at the University of Maryland, we developed an improvement–oriented organizational model for software development. This model addresses not only (1) the construction of software products, but also (2) the planning of the construction processes, (3) the control of the construction processes, and (4) the necessary learning from each project in order to do it better next time. Real software engineering requires predictability and controllability of software construction as well the ability to learn and improve. Measurement is necessary to perform all four stages of the above organizational model effectively. The commonly known life–cycle models only address the construction of software.

Software Engineering Environments (SEEs) are supposed to support software development processes effectively. They can be viewed as 'partly automated' instantiations of the process models they are supposed to support. Most commercially available Software Engineering Environments (SEEs) contain only tools for software construction and are based on a single life–cycle model (if at all).

In the TAME project, we suggest that an effective SEE is an instantiation of the above improvement–oriented organizational software development model. We refer to such SEEs as Integrated SEEs (ISEEs) because they (a) integrate planning, construction, control and learning activities, and (b) use measurement as a built–in mechanism to support all these activities. The TAME project explores the potential of measurement to support planning, control and learning activities in the context of ISEEs. A series of prototype TAME measurement systems are being built. A number of other research projects emphasize different ISEE aspects within the same model (see [9], [12], [13], [15], [17], [20]).

In this paper, I present the improvement–oriented organizational software