

Position Paper for Dagstuhl 2007 EUSE Workshop

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In this brief position paper, I summarize four strands of work underway in our Informal Learning in Software Development research group at Pennsylvania State University. The work contributes to end user software engineering by considering the needs and characteristics of end user web developers.

1 - Analysis of end users' needs with respect to web development

We have conducted survey and interview studies of nonprogrammers who have some experience with web development to assess current practices, problems, needs, and attitudes. Our results indicate that the informal web development population is quite diverse, with participants ranging in age from under 20 to over 55. In fact in an opportunity sample web survey, the largest age segment represented was over 55.

Self-reported web development expertise is correspondingly diverse, ranging from self-taught expert programmers to users who rely entirely on high-level application builders. However even the least experienced users report a need for relatively sophisticated web technologies, for example database interaction and user authentication. Attitudes and practices related to software engineering (e.g., attention to design and testing) are correlated with self-reported expertise, but vary in complex ways with other personal characteristics like curiosity and carefulness.

2 - Analysis of personal variables related to end users' development of web applications

Again by combining across survey results and lab studies, we are starting to see some patterns in personal variables associated with web development expertise and

practices. Of particular interest has been gender as a factor. Quantitative analyses have been difficult because person variables tend to be highly inter-correlated and opportunity samples tend to have fewer women than men. However, using multiple regression techniques, we have found that gender is associated with some measures of web development expertise; other factors associated with expertise include the context in which the development is done, age, and the "carefulness" of a person's general working style. In a lab study, we also saw a small role of gender in predicting success with an experimental tool for end user web development, but cognitive abilities like visualization and logical reasoning were more influential as factors.

3 - Analysis of critical obstacles to end users' development of web applications

These findings also resulted from a combination of web surveys and interviews. In interviews with community webmasters, we found that many obstacles to providing working applications were socio-organizational in nature, for example the requirement to use a tool mandated by an organization but that causes problems for the developer. In general across both the interviews and surveys, we found that one of the most common problems in end users' web development activities was collecting, merging, and formatting content from other colleagues. At a technical level, some of the most irritating and frequent problems were also those that are most basic and amenable to tools – making sure that all the links are always working and getting layouts and format to look right and to work correctly on different browsers.

4 - Development and evaluation of a tool for end user web development

We have found that a significant proportion of end users' concepts for web applications can be satisfied with a tool that supports simple data-oriented applications (e.g., member directories, personal information or inventory management). CLICK (Click, a Lightweight Internet Construction Kit) is a prototype tool for supporting such development. It uses an interactive drag-and-drop user interface, with scaffolding provided by built-in wizards for common tasks (e.g., setting up a data table), dialog boxes that guide behavioral specification (e.g., prompting with currently available actions that can be connected to widgets), and a to-do list that monitors tasks that are still incomplete (e.g., creating a web page referenced in another part of the system). Usability evaluations have confirmed that sophisticated end users can learn to use CLICK enough to build a simple application in about one hour.

Future issues related to EUSE research

A significant issue for EUSE is related to end users' motivation to learn and use software engineering practices or techniques. People are active users; they do not want to stop what they are doing so as to evaluate their progress, make corrections, and do a 'better job'. The learning that they accomplish must come through *informal* means, for example goal-oriented help information, interactions with colleagues, or intelligent systems with just the right amount of initiative. As researchers we need to bear this in mind as we invent new techniques and methods: if we build it, will they come?

A related issue concerns the use of intelligent systems techniques. Intelligent systems can address users' minimal motivation by monitoring or correcting work. However, these systems are difficult to build with just the right amount of initiative—knowing when to jump in and with what level of assistance is critical, as too much help may be annoying or

patronizing (as well as wrong) and may also decrease what the user is able to learn on his or her own.

One approach to helping users raise the quality of their problem analyses, designs and coding techniques is to support collaboration within a community of end users (e.g., within programming domains like web development). Although any individual user may not be willing to take the time to discover a solution or a useful tool, a community may be able to provide this support. However we still know very little about how end users may or may not wish to collaborate in their development activities, and more generally about how to build effective online community systems.

There is enormous diversity among end users who build software, particularly web software. As we build tools and training for EUSE, we must be careful to analyze the differential needs of varying user groups and create systems and tools that support a broad range of learning styles, motivation, and work contexts. An important societal concern lurking behind this programmatic suggestion is the digital divide—as end user development tools become more useful and available, the gaps and consequences of varying levels of computer literacy may become even more pronounced, with the consequence that some population segments become even more marginalized.

References of interest

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