

# Towards a groupware environment for collaborative programming learning

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Students of computer programming face diverse difficulties, such as using a programming language with constructions that they find abstract as well as unfamiliar but that must be used to solve problems in an effective way (Karsten & Kaparathi, 1998). They will have to overcome these difficulties in order to acquire successfully the skills they will need in their professional activity. In answer to those problems, the aim of the research work reported here is to study the combination of advanced groupware systems for computer programming, techniques for analyzing student interaction and collaboration (Bravo et al., 2008), and intelligent tutoring based on generation of advice and guidance, with the objective of creating a learner-centred environment based on CSCL principles and following a learning by doing approach by means of problem solving.

The present systems for collaborative programming, e.g. DPE (Jo & Arnold, 2003), lack a suitable educational approach. There are only a few CSCL environments for programming learning, e.g. JeCo (Moreno et al., 2004), but they present limitations with regards to advanced communication, coordination and awareness tools, and to specific tools for collaborative programming. So far attempts to turn ECLIPSE into a groupware tool, e.g. Jazz Sangam (Devide et al., 2008), have not gone beyond incorporating instant messaging, audio and video-conference, control version systems and strongly-coupled collaborative editing.

We deal with these gaps by proposing a groupware environment based on ECLIPSE that develops the principles and incorporates the techniques mentioned above. We chose ECLIPSE because it is a real-world IDE, very extended at academic level and well-established in industry. Moreover it facilitates the incorporation of new tools through *plug-ins*. Fig. 1 shows a first prototype of such an environment, incorporating a session panel showing the member list, a tool for handwriting on the source code, a structured chat (which offers a set of pre-established communication acts) and a coordination tool for floor control. These elements incorporate a few awareness elements such as the users' state and a semaphore indicating when participation is required in the floor control tool.

The groupware environment presented includes the following tools: (i) coordination and decision-making tools to harmonize synchronous collaborative work; (ii) a structured chat; (iii) an audio and video-conference tool; (iv)

awareness tools (tele-pointers, radar views, session panel with participants' state, etc.); (v) a collaborative planning tool, to define the problem-solving strategy; (vi) a handwriting tool for the annotation of programs; and (vii) advanced collaborative programming tools (editing, compiling and executing), including collaborative monitoring of variables during debugging and the shared visualization of compilation errors.

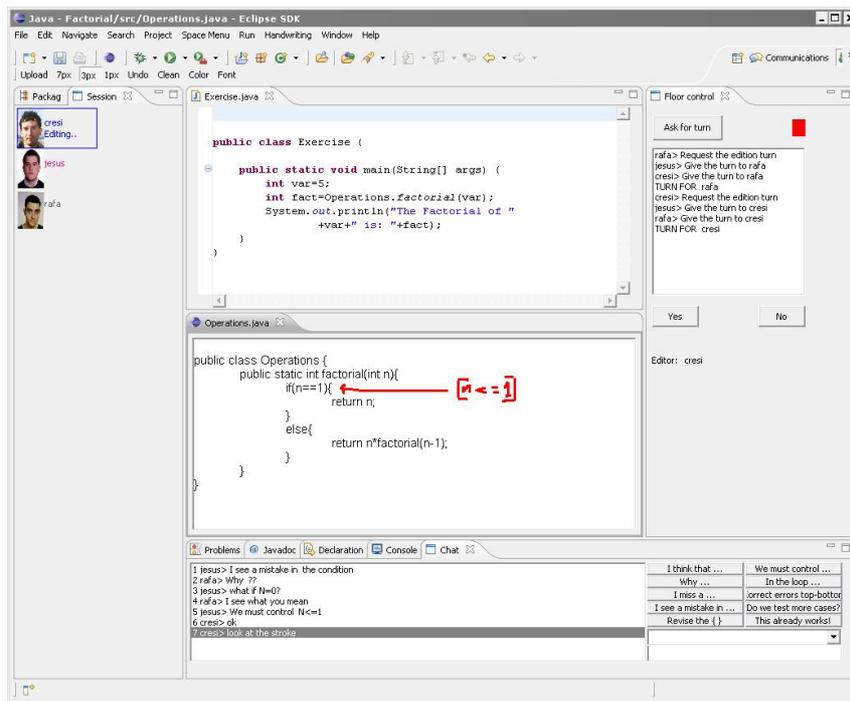


Figure 1. Prototype of collaborative programming learning environment.

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