Action Research and the Unified Process: Can They Match?

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ABSTRACT

Action Research has been used for the improvement of processes which help researchers to learn from actions in defined situations. The Unified Process has been developed as a framework for implementing software. This paper reports on the combination of a reflective approach like the Action Research method and an object oriented development process like the Unified Process to improve project management in software engineering projects for cost-effective reasons.

THE TECHNIQUES

Action Research

The aim of Action Research is to improve practice and it is typically conducted by a researcher who is practitioner at the same time. When researchers plan to make experiments they observe actions of other persons for example. The Action Research approach differs from this method because the subjects of investigation are the researchers themselves. When referring to the implementation of a virtual community web support application the researchers are the project managers and have to observe their own action for improving the steps towards other projects.

Figure 1 shows the steps how Action Research works: It begins with diagnosing possible lacks of a scientist (the project manager). After this step, the scientist has to plan and take action (with or without asking the defined group of students or project team members). Then the evaluation of the action being taken takes place; without this step action will only be described but not be improved! After specifying the learning steps the diagnosing starts over again to improve the scientists´ (project manager's) behavior.

The Unified Process as an alternative to other models

Limitations of the Spiral Model
Basically, the idea is evolutionary development, using the waterfall model for each step; it's intended to help manage risks. […] The developers should only define the highest priority features. Define and implement those, then get feedback from users/customers […]. With this knowledge, they should then go back to define and implement more features in smaller chunks. [BOEH86]

One of the roots of the unified process is this model but on an advanced level. Ideas like project management are still lacking in this model, which is already implemented in the unified process.

Limitations of Extreme Programming
"Extreme Programming (XP) is a […] method developed by Kent Beck, Ward Cunningham, and others [BECK00]. […] Key practices include pair programming, writing tests upfront and rebuild continuous integration and testing. Key principles incremental and iterative development, working with the simplest solution, cutting out extraneous documentation and collective code ownership." [EMER02]

Watts Humphrey [HUMP01] enumerates an equal long list of advantages and disadvantages of XP. Here the author mentioned some selected disadvantages of XP:

1. Code-centered rather than design-centered development: Although the lack of XP design practices might not be serious for small programs, it can be disastrous when programs are larger than a few thousand lines of code or when the work involves more than a few people.
2. Quality through testing: A development process that relies heavily on testing is unlikely to produce quality products.
3. Obtaining management support: The biggest single problem in introducing any new software method is obtaining management support.

Alternative: The Rational Unified Process®
The Rational Unified Process can be tailored to include some of the practices of XP. […] The Rational Unified Process is a process framework that consists of phases, workflows and at least one iteration per phase. When starting to develop software in general many problems can occur such as the definition of costs, properly defined requirements, adaptable for future application developments. For solving these problems it is necessary having clearly defined repeatable processes, which support team members in each phase of the developing process.

The figure above shows how the recurring process in a software development model takes place when using the Unified Process. When using other development models than the Unified Process project managers not always are aloud to step back to other workflows. In the

Figure 1. Action research model (after Susman 1983 in Baskerville & Wood-Harper, 1998, p. 96)
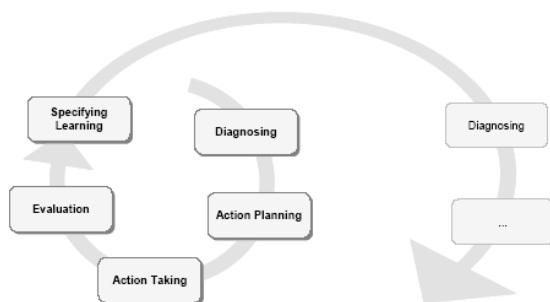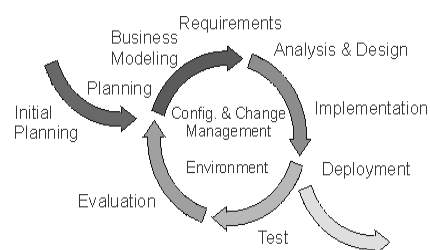

Figure 2. The recurring workflows of the Unified Process [MALU03]

Unified Process this can not happen because of the iterations in all four phases of the model, where a project manager can start a further iteration when some of the use cases in the inception phase in iteration 1 may have not been defined or modeled. In complex software systems like virtual communities it is necessary to have the possibility to step back for improving or redefining actions.

Virtual Communities

The author's virtual community can be seen as a platform, where different actors meet: lecturers, students and organizations.

Lecturers are responsible for filling the system with content so there is a need for classes like "Subject" or "Deadline" to allow lecturers to be responsible for many classes with different content.

Students are responsible for uploading their home works they have to hand in, so "their" classes are "Subject" as well or "home works", etc.

The third actors are the organizations: Nowadays lecturers are working in different organizations or students study at different universities even on different places. So how to implement this situation? When a lecturer teaches a subject at two different universities it is important to divide the content the lecturer puts into the system. On the other hand students need to know at which university they have to hand in the requested home works. To implement this circumstance it is necessary to introduce the third cornerstone in this community: "the organization". Therefore one of the classes is "name of the organization" or "type of the organization" or "country".

THE REFLECTIVE PROCESS

The Unified Process allows the project managers to add as many iterations as they need for the successful completion of their project. On the other hand there is the philosophic approach of Action Research where a project manager tries to analyze the actions of each iteration or the whole project.

On the figure below the arrow between these two orthogonal approaches can be seen as the "missing link". Merging them can lead to problems, like the misunderstanding of each approach when having the opposite background ("How can a psychologist work in a software project and why is it necessary to research in software science when working on psychological aspects?") The big advantage of combining them is the learning effect on both sides when using them as project managers who are used to work more result-oriented. By the usage of the action research approach project managers get the opportunity to improve their work and the team members´ work as well when reflecting on the work of them in well defined reflective situation at the end of each iteration. This combination also means that action research uses a similar iterative process, in which the researcher evaluates results at the end of an iteration.

Figure 3. Development of a virtual community web application by using the Unified Process and the Action Research approach [MALU05]
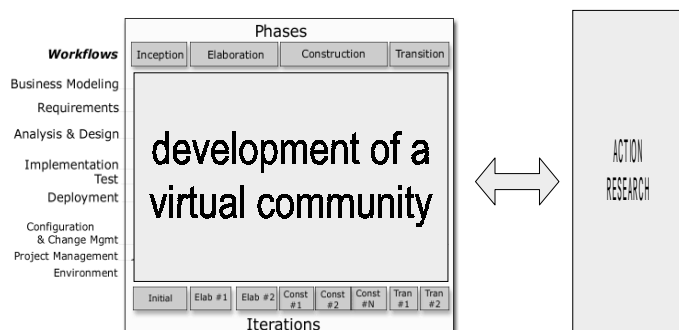
EMPIRICAL WORK

Regarding the connection between a software development model and qualitative research methods like the action research approach it will be explained how the experiment will be done: Two different groups are developing the same application, both project managers will use the unified process for the development, and one of them is also using action research for the reflection of the team's work.

EXPECTED OUTCOMES AFTER END OF EXPERIMENT

The author defines two possible solutions: One possible way is the definition of "fixed components", "non-fixed components" and "semi-fixed components" on the "micro-level" of the Unified Process (the terms are defined by the author himself). The second solution refers more to the learning aspect of project managers in every single project (this happens on a "meta-level" – also defined by the authors):

1) Fixed components: The four phases of the Unified Process are fixed, because of the method itself. This aspect limits the approach to four phases with no addition or deletion of any of the phases.
2) Non-fixed components: The workflows in all Unified Process developing models are described like in section 3, but project managers also have the possibility to change the workflows.
3) Semi-fixed components: The Unified Process defines a project management discipline that guides the project manager through iteration management, but at least one iteration per phase is needed.

Regarding the development of this application Action Research will happen in two different ways: 1) in the several iterations of one single project (the so-called "micro level", defined by the author by improving the actions taken in the iteration before as already mentioned and 2) the learning process of the whole project (the "meta level").

Whenever project managers lead more than one project they can use the Action Research approach for improving their abilities as project managers: assuming that a project has been finished, the first action is to analyze what was going wrong in this project? The project leader should reflect on all the occurred problems to improve for the next time. This can happen through processes of self-reflection or by getting feedback from members of a project team.

The advantage for developing applications by using the described methods can be stated in the reduction of costs and time savings on the other hand.

Regarding the "Chaos Report 2004" [CHAO04] it can be read that many projects in IT have a longer duration than they were originally planned, that lead to a waste of resources and to an increase of costs. Combined with the Action Research approach projects can better be planned, because the project manager has to take into account that several iterations will be necessary (when requirements cannot be clearly defined in the first iteration, etc.) and is therefore able to plan them.

CONCLUSION

The Action Research […] responds directly to the pronounced needs for relevance in information systems research, and provides a rewarding experience for researchers who want to work closely with the practitioner community. [BASK05].

Action Research and the Unified process are two methods which can match. Stressing the iterations of the Unified Process and the "meta-level"-aspect as described, active practitioners (project managers) can use the Action Research approach for implementing software based on the Unified Process.

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