POSITION PAPERS
Project management and management of design: Teaching and tools

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Abstract

While there are many project management tools and software packages available, these are not widely used in the design curriculum at colleges and universities. This may reflect some of the differences between conventional projects and design activities. In particular, the open-ended nature of design activities and the need to clarify the client's intention may lead to the conclusion that conventional project management tools are only useful for the most routine activities in the design process. It is suggested that there is a market for a new set of tools for teaching the management of design. These tools should incorporate the most useful of the current management tools and integrate them with some of the requirements of effective design, including support for clarification of objectives, functional analysis, and generation and evaluation of alternatives.

Keywords: Project Management; Management of Design; Teaching of Design

There is no shortage of tools for use in project management. In fact, the number and depth of tools itself presents something of a barrier to teaching students easily about project management issues. Unless one is careful, the student can create extraordinarily attractive project graphs with little or no real management content, and submit these documents as evidence that they are ready to manage projects. With appropriate questioning and examining, the students can be drawn back to the mundane but essential activities of determining tasks, assigning resources, and developing realistic budgets. Unfortunately, management of engineering design activities offer the educator no such recourse. There are few texts, and no software tools of which I am aware, that focus clearly on managing design. This raises several important questions for educators. Why are there no tools and so few texts? Are they on the horizon? Are they even necessary? There are several possible answers to these questions:

1. One may argue that project management and management of engineering design are essentially the same activity, and that the tools are available in the form of the standard project management suite.

2. Another explanation may be that the management of design is so poorly understood that we cannot develop tools to support it at this time.

3. It may be the case that the management of design is sufficiently understood but our understanding leads software developers (toolmakers) to conclude that it is somehow inappropriate to build software tools like those for other management-type activities.

4. Finally, it may be that there has simply not been a market for tools to support the teaching of design management.

If the first of these is true, then it is certainly incumbent upon teachers of design to develop a much better understanding of the current set of project management tools, and adapt teaching styles to incorporate them. The obvious question, however, is why they are not used more in teaching design. Certainly, the best teachers are aware of and experienced in using project management tools and managing design projects—indeed, it is their practical experience in design that is usually at the core of effective teaching. I would argue that project management and management of design

are themselves different in several key ways: while a design activity may be a part of a larger project (or even the whole of the project), the two activities differ in terms of prior knowledge of the intended output and in the relationship to the client. A project is generally characterized in ways such as "a one-time activity with a well-defined set of desired ends" (Meredith & Mantel, 1995). Successful project management is usually judged in terms of "scope, budget, and schedule," and "it is important that all three of these components be clearly defined" (Oberlander, 1993). Design activities, on the other hand, are often remarked upon as being "open-ended" or "ill-defined" (Dym, 1994). Another key difference lies in the relationship with the client—design activities often include specific actions to understand what the client needs and wants, while this is already established in most projects. These differences manifest themselves in the types of tools likely to be of use to practitioners and teachers.

Project management tools such as work breakdown structures, work packages, cost breakdown structures, and critical path routines are readily available to assist managers in allocating resources, developing schedules, and monitoring progress. Design management tools, on the other hand, must assist the designer in planning, organizing, and controlling a series of emerging tasks to support an often initially unknown end. This is not to suggest that design activities do not use the standard project management tools. Indeed, in our introductory courses in design we introduce students to these techniques as a key means to gain control over the more routine dimensions of team and project activity. It is, however, in the nature of design activity that such tools may not suffice to control the design project. I suspect that this is particularly true in the early stages of the design process.

Returning to the reasons for the dearth of effectively used tools, I simply do not believe the second or third alternatives to be the case. While it is certainly true that some designers may manage themselves poorly, and some teachers may overlook management of the design process, there is simply too much evidence of good, well-managed design to believe that it is unknowable or beyond effective communication. If the management of design is well understood and merely not amenable to software, then the lack of other, noncomputer-based, effective teaching materials is certainly puzzling.

The most hopeful answer lies in the last alternative. Workshops and seminars such as the recent Harvey Mudd symposium, *Computing Futures in Engineering Design*, begin to demonstrate that a market is emerging. This then raises the question of what the content of design management tools should include. I would maintain that they must include support for clarification of the client's goals, functional analysis, generation and evaluation of alternatives, as well as some elements of what has traditionally been thought of as project management software (task-organizing tools, scheduling rou-

tines, and monitoring and control routines). This would be, in fact, an ambitious undertaking, and would require that teachers of design focus clearly on how their activities are similar to and differ from other project-based parts of the curriculum.

In spite of my disclaimer about the ambitious nature of such development, I have given the matter some thought and would like to share a few observations. It is probably true that the nontraditional (i.e., design-specific) tools would be the most difficult to develop, but these should almost certainly precede any focusing on conventional project planning tools for several reasons. First, the conventional tools are already available and are little used, so addition of another set seems foolish and wasteful unless they are clearly integrated into a fuller set of design support tools. Second, I believe that careful articulation of the objectives and functions of the design-specific tools would help clarify which of the conventional management tools need to be used and therefore taught as part of design education. Finally, I believe that engineering students perceive formal design methods and management tools with some suspicion, characterizing them as either irrelevant or humanities in many cases, and so the more obvious formal design tools would probably help them to see at least some connection with their *a priori* notions of engineering and science.

A final observation is that our students are much more comfortable with computer-based tools and computer-based learning than most of us were or ever will be. As such, it is certainly possible and probably necessary to develop tools to support the management of the design process that have computers and computer-based interactions at their very core. This is in contrast to what I often see in texts where there is a diskette at the rear of the book, which the teacher and student can discard if they wish. If we are going to approach this subject from the perspective of teaching design and design management rather than simply describing it, we will be required to be much more aware of computers and the possibilities they allow.

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