INTERNATIONAL DESIGN CONFERENCE - DESIGN 2004
Dubrovnik, May 18 - 21, 2004.

DESIGN 2004

PROFILING DESIGNERS AS A BASIS FOR ASSESSING DESIGN PERFORMANCE

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Keywords: multi disciplinary design teams, design communication, design management

1. Introduction

This paper distinguishes between designers who are successful as individual designers and designers who are successful members of design teams, with particular reference to Multi-Disciplinary Design Teams (MDDTs). The paper outlines results of research which has used various methodologies from the social and behavioural sciences to analyse various mental and behavioural aspects of the design processes used by professional design practitioners in the design-team workplace environment.

2. Design education

Most design education prepares students to be individual designers, with all the design skills required to undertake design within a particular design discipline such as Architecture, Industrial Design and Engineering. Architectural education recognises certain specialisations such as building, urban design (or urbanists) and urban planners, and all these are taught as distinct subjects within a common programme so that, at graduation, an architectural graduate has various levels of developed understanding of each of these specialist areas. Engineering education recognises more distinct specialisations such as civil, mechanical, electrical and chemical engineering and generally provides separate education programmes for each (usually after a common introductory degree), so that an engineering graduate has a developed understanding of only one of these.

Debate about the relative merits of a broader ‘generalist’ education versus a more focused ‘specialist’ education has raged in Architectural and Engineering Education for as long as anyone can remember, and is generally driven by divided perceptions within the respective professional disciplines and professional accreditation authorities [Cowdroy & Chapman, 1999]. Most professional accreditation authorities are divided over the question of whether graduates should have concentrated high-level skills in the area of expertise of the practising profession, or a broader range of ‘real world’ skills across the range of practical applications regularly encountered in professional practice [Maitland & Cowdroy, 2001].

On one hand, practical limits of education prevent the achievement of concentrated high-level skills across the broader range of practical applications, but on the other hand, narrow concentration of education in the area of expertise leads to criticism about lack of relevance to the ‘real world’ realities of professional practice [Cowdroy & Chapman, 1999]. A frequent answer to this impass is a claim that only high-level expertise skills should be taught formally (eg, in universities) and that ‘real-world’ skills should be learned through ‘work experience’ (eg, through internships after graduation and before registration). However, our research has shown that teaching professional practice through work experience provides very poor professional development that is ultra-conservatives and reinforces archaic methods and ‘bad habits’.

In many cases a compromise is reached by offering postgraduate specialist programmes to allow graduates to become ‘expert specialists’ in particular types of design (eg, very tall buildings, and earthquake design for bridges, and tunnels). In some regions, completion of particular postgraduate specialist programmes is a requirement for registration to practice in that region.

In all the above situations, however, the training of design graduates is based on an assumption that the individual graduate will be ‘the designer’. Even where ‘group design’ is included in the education programme, the group is typically composed of designers from the one discipline (ie, all architecture students or all electrical engineering students).

3. Real-world design practice and multi-disciplinary design teams (MDDTs)

The ‘real world’ however is not so polarised, and most design graduates soon find themselves in design teams [Lawson, 1990, p.184] made up of experts from many different disciplines. The design of a train, for instance, is an engineering design project that involves many engineering experts (eg, mechanical traction, electrical switching and distribution, seating, automatic doors, safety systems) and multiple manufacturing experts (eg, sub-frame and suspension assemblies, rolling systems, windows, doors, painting and testing) and all these experts must ‘practice’ within a multi-disciplinary design team (MDDT).

The design of a major building (eg a hospital or research building, or a tall office or apartment building) also involves a design team that is multi-disciplinary and involves a wide variety of experts including building-design architects, interior design architects, urban and landscape design architects, structural engineers and hydraulics, electrical and emergency services engineers (and many others), who must practice within a MDDT environment [Peng, 1994].

3.1 Individual participation in MDDTs

A significant factor in MDDT environments is that the ‘expertise’ that is paramount in the operation of the design team changes continually. For instance in the train-design example, the design process moves on from defining performance criteria to defining weight, size and manufacturing limitations, and then to general design of assemblies, then detailed design of components, and then methods of assembly and connection between diverse components (eg, welding, rivets, adhesives) and sequences of assembly, and the expertise at the ‘centre’ necessarily changes from stage to stage.

If all the ‘experts’ are narrow specialists (reflecting the model graduate) they will tend to follow a rational, ‘logical’ sequential design process from the detail part towards the complex whole, and the intended horse will turn out to be a camel. The need is invariably for the design to commence with a defined outcome (a concept of the completed product as a whole) that is understood and shared by all members of the MDDT (including those who will be members for only part of the time of the overall design project), and for each member to “collaborate” in the design of all components of the whole.

In order to understand and share the concept of the completed product, each member of the MDDT must be able to undertand the ‘position’ of most or all of the other members, and must therefore have some understanding of the design issues of the other members, including alternative design possibilities that will allow a ‘best-fit’ among all the design issues of all members. This suggests the need for a broad understanding of range of disciplines as well as a specialist knowledge in a particular discipline.

4. Management of MDDTs

A management or coordination expert is often appointed to lead a design team, to overcome competitiveness and conflict between members and to maintain progress, but this does not ensure a cohesive design process or a successful product. Research and experience has shown that a ‘facilitation’ management approach is essential to achieving the ‘shared’ understanding by all members of a MDDT of the whole complex network of design issues in any complex project as Lurey and Raisinghani [2001] state:

> "…team leaders need to establish positive team processes, develop supportive team member relations, create team-based reward systems, and select only those team members who are qualified to do the work... These factors, then, clearly constitute the beginnings of a comprehensive set of best practices to be used when designing and supporting effective teams, regardless of whether they are co-located or virtual."

This facilitation approach must allow each member of the MDDT to present and discuss design issues in his or her specialist area without intimidation or domination by other membrers, so that the issues and implications of all design decisions, even at the detail level, are understood and shared by the whole team, and so that the whole team is satisfied at each 'sign-off' stage of the project [Galegher, 1990].

A particular difficulty in most MDDTs is the hierarchical ranking of the various members, and a consequent tendency for higher-status members to dominate discussion and for lower-ranked members to maintain 'respectful silence'. This is particularly the case when the MDDT includes some members who are highly-qualified design professionals and other members who have less design qualifications (or no design qualifications) such as manufacturing specialists and sub-contractors. In these cases, it is essential that a 'facilitation management approach be established so that the lower-ranked members are heard and have equal say in the design process, and that higher-ranked members recognise the importance of other members' contributions.

The manager-facilitator clearly needs to have a broad general knowledge of all stages of the project, and to have the ability to 'control' high-status members of the MDDT (who often have higher rank than the manager-facilitator) and to have the ability to enable lower-status members to participate on equal terms. A manager-facilitator with formal design qualifications and practical assembly experience is likely to be more appropriate than a manager with highly-specialised (narrow) design skills or a senior executive with financial skills and authority. Regrettably, in a competitive commercial environment and in many government authorities, the financial 'bottom line' is often seen as justification for appointing a finace executive to manage design teams, usually with disastrous results, technically and financially.

5. Individual designer profiles

Collaborative skills and attitudes must also be developed among the MDDT members. Even the best manager-facilitator cannot achieve a successful design process and product if individual members disrupt the equal sharing of the design process. In this respect, our research has shown that collective team responsibility for the whole process and product is significantly more important to success than individual expertise and responsibility. Regrettably, many graduates have been encouraged to assume that they should have sole authority over their discipline area, even within a team environment, but this results in a group of individual experts who cannot contribute effectively to the integration of all the separate parts into an effective whole.

Our research has also shown that the various members of a successful MDDT have distinct individual profiles [Crick & Cowdroy, 1999] which include their respective expertise, ability to lead discussion on issues focused around their particular area of expertise, and to actively participate (but not dominate) in discussion focused around areas of other members' expertise. The individual profiles include collaborative attitudes, interactive skills and, particularly, confidence to accept shared responsibility for design decisions in the areas of expertise of all other members as well as in their own area of expertise.

6. Expertise versus success

As indicated above, our research has shown that there is a distinct difference between 'expertise' and 'success' in design practice, which is predominantly undertaken in a multi-disciplinary team environment. Expertise is clearly necessary, but is ineffective without the additional interactive skills and attitudes required to achieve success as a participant in a design team, particularly in the context of complex products.

Design education, however, is focused on developing the technical skills associated with expertise and rarely includes provision for development of interactive skills and attitudes. This shortcoming is exacerbated by the student assessment and award systems which reward individual achievement of high-level expertise skills and ignore interactive (cooperative and collaborative) abilities in students and graduates [Institution of Engineers, 1996].

In this respect, our research indicates that many students who have the appropriate interactive abilities and attitudes are disadvantaged in the assessment processes, or are forced to suppress these qualities in the competition for high grades and scholarships based on narrow expertise skills [Chapman & Cowdroy, 2000]. A result is that the graduates with the highest grades (eg, high distinction and first class honours) get the highest-status jobs but are often dissatisfied by the interactive demands of professional practice, and are disappointing to their employers, leading to mutual miss-match of expectations and criticism of the quality of design education by both graduates and employers. Graduates with more modest grades (eg, high credit and second-class honours) tend to have a better balance between 'expertise' and 'success' skills and attitudes, and adapt more easily to the demands of design team environments [Williams & Cowdroy, 2002].

7. Methods

The research referred to here includes several individual cross-disciplinary projects within an overall major inter-disciplinary (and international) project to define professional performance indicators for the design professions, particularly in Engineering and Architecture. The individual projects have employed a range of methodological approaches drawn from psychology, sociology, education and management. As researchers, we practice what we preach and undertake our research interactively in a collaborative, cooperative multi-disciplinary research team environment.

Studies of students, recent graduates and design practitioners have been undertaken using multi-stage cross-cultural interview methods from psychology, and included linear studies of graduates proceeding through their internships into full professional practice in various design disciplines (including architecture, urban design and engineering) from universities in Australia, Netherlands, Belgium and France. Further studies of profiles of design practitioners employed a combination of mult-stage cross-cultural methods and management science (particularly decision science) and involved design professionals in Australia, Britain, Europe and North America.

Studies of MDDTs were undertaken using passive observation of design teams in action, followed by interactional and protocol analysis from sociology and anthropology. These studies followed the progress of the teams through various stages of design of complex projects for the Hong Kong urban transit project and Locomotive for National Rail, Australia [Williams & Cowdroy, 2002].

8. Conclusions

These studies focused on the relationship between individual technical expertise and individual success in applying that expertise in practice, particularly in multidisciplinary team environments. The studies show that students, recent graduates and experienced designers can be individually 'profiled' for appropriate technical and interactive skills and attitudes required to meet the demands of successful practice in multi-disciplinary design team environments, which account for a very large and increasing proportion of practice in the design professions. The studies also showed that the most successful practitioners (in terms of both awards and advancement in employment or business) were those with strongest interactional skills, and that those with poor interactional skills rarely made it to the top, regardless of their level of expertise.

These studies imply that the design professions' excessively narrow focus on individual expertise as the indicator of success (in accreditation criteria for undergraduate education, and award systems for graduating students and established practitioners) are counter-productive to the development of successful practitioners, particularly those who will be consistently designing in a MDDT environment. This anomalous focus of the design professions is reflected in design education which concentrates on expertise in individual technical skills, and ignores the interactive abilities and attitudes that are essential (in conjunction with expertise) to *success* in professional practice. Our research indicates that education which concentrates only on *expertise* skills, in the absence of interactive abilities and attitudes, is of limited value to the 'real-world' demands of design practice.

This would reinforce the concept that both people and process issues are important when considering project team dynamics, and links to a growing trend in the industry to form partnerships and alliances which, if taken to an extreme, encompass the entire supply chain. Love et al [2002] present a model for construction alliances which emphasizes a, "*…collective learning environment"* as a key element.

Our research therefore concludes that high levels of success are generally *not* consistent with high levels of expertise, and (by corollary) that high levels of expertise are insufficient (and often detrimental) to success, in both individual and team design situations. Some design practioners will practice as individuals, and may well be successful with only expertise skills. However, the research identified various *success profiles* which are quite distinct from conventional concepts of *expertise* and differ according to whether the designer is expected to work primarily as an individual, or as a member of a MDDT, in a range of design disciplines including engineers, architects, urban planners and industrial designers.

The concept of *success profiles* challenges conventional design education paradigms and provides an alternative basis for reviewing and evaluating our curriculum and assessment protocols for all design disciplines.

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