IMPROVING THE DESIGN PROCESS FOR ADAPTABILITY: LINKING FEEDBACK AND ARCHITECTURAL VALUES

Graham Kelly[1], Robert Schmidt III, Andy Dainty and Vicky Story

Civil and Engineering Department, Loughborough University, Loughborough, LE11 3TU, UK

Designing for adaptability intuitively requires an understanding of how buildings tend to change over time. This, in turn, suggests that architects could learn from and accumulate knowledge as their buildings evolve and change over time. On the other hand, the ways architects learn through conventional forms of feedback are not conducive to them learning about the effectiveness of their designs in use. For example, they tend to focus on the visual, whereas most feedback is provided in the form of check boxes and reports. Current feedback techniques are also heavily focused on performance metrics captured at one point in time. In this paper it is argued that feedback focused on how buildings are adapted over time should be integrated as part of the design process, informing architects of what has or hasn't worked, and what could be improved. The research addresses the need for a technique that will inspire architects to utilise feedback more effectively. Semi-structured interviews were conducted with seven UK architects in order to better understand how feedback informs their design decisions and whether more appropriate methods could be devised to improve the design process for adaptability. The analysis reveals that current feedback mechanisms are not sufficient for capturing feedback for adaptability, nor do they present the material in a format that fits into an architects' current mode of operation. The data suggests that architects are interested in learning about how buildings can accommodate change and that a tool that presents the captured lessons of past projects in a visual way, could improve the utilisation of this feedback.

Keywords: adaptability, architectural values, design decisions, feedback.

INTRODUCTION

Instinctively, designing for adaptability requires an understanding of how buildings tend to change over time, hence in order for architects to improve the design process for adaptability they should learn how buildings evolve. However, given the way architects learn, conventional forms of feedback are not thought to be conducive to learning about the effectiveness of designs in use. Feedback in its broadest sense is "a means of learning from experience by carrying out the processes of reflection and deduction" (Andreu and Oreszczyn, 2004). A number of feedback tools for construction have been developed. However, conventionally, the majority of these are bundled under the generic term Post Occupancy Evaluation (POE), and are focused on building performance in use. These tools do not support learning for adaptability and are mismatched with regards to architects' values and practices. This is supported by

[1]g.kelly@lboro.ac.uk

Kelly, G, Schmidt III, R, Dainty, A and Story , V (2011) Improving the design process for adaptability: Linking feedback and architectural values *In:* Egbu, C. and Lou, E.C.W. (Eds.) *Procs 27th Annual ARCOM Conference*, 5-7 September 2011, Bristol, UK, Association of Researchers in Construction Management, 43-52.

Heylighen *et al.* (2007) who state that "architects do not appreciate the importance of knowledge capture because of the additional overhead required to document the process, context, and rationale of a design project. If knowledge is captured, it is often limited to formal documents. In other words, architects have no incentive to capture knowledge." This chasm is exemplified by the fact that architects often learn by trial and error rather than assimilation (Wang, 2010), and prioritise the 'visual' as a key value (Cohen *et al.*, 2005). Given that feedback mechanisms tend to be produced in the form of check boxes and reports (Bordass and Leaman, 2005), there are very few feedback mechanisms that respond to the preferred ways in which architects learn. This, coupled with the majority of feedback being concerned with performance metrics at a single point in time (often within the initial year of use (Kelly *et al.*, 2011)), renders accounting for user appropriation of the building problematic.

The research explores how feedback focused on buildings in use over a period of time can be better integrated into the design process. In order to do this, the paper investigates the extent to which current feedback mechanisms match architects' values, and what new or revised mechanisms could be developed to respond to any identified disparities. First, the paper critically reviews literature on architectural values and current feedback mechanisms in order to identify where potential deficiencies lie. It then presents a framework that considers the different ways in which buildings change over time. The methods are then described, followed by initial insights gleaned from the data and key implications.

EXPLORING ARCHITECTURAL VALUES

Cohen *et al.* (2005) suggest that an architect's values are what set them apart from other professions when it comes to the concept of designing buildings, and shape why architects design the way they do. Broadly, values are defined as principles, standards, and qualities that guide actions (Le Dantec and Do, 2009), they are said to dominate architects' work and education (Cunningham, 1980). This infers that for any type of feedback to work it has, in some way, to match these values. These values can come from an architect's education or experience, motivate their decisions and guide their behaviours.

Given that values have a significant impact on how architects design, it is important to understand how these are shaped in order to conceive how best to respond to them. In this respect, architectural education is very important as it sets the foundation as to how value systems are shaped within the profession. Most architectural programs emphasise innovation and novelty, with a focus on creativity (Glasser, 2000). This is also highlighted by Cuff (1991) who suggests that architectural education has, for a considerable amount of time, been based around learning how to be creative and thinking for one's self. Lawson *et al.*, (2003) continues this theme, advocating that 'knowing by doing' is a readily accepted method of educating within architecture. There is also a strong emphasis on aesthetics and visual presentation which comes to the fore in both the teaching and assessment processes (e.g. CRIT) (Brady 1996). Once in practices, the continual gratification of experience and aesthetics is reinforced through the rewards structure, internally through the way promotions are administered and externally through organizational and design awards (Till, 2009). Spector (2001) also states that ethics and a feeling of social responsibility are important to architects as they aim to "protect the public against the dangers of shoddy and insensitive buildings" (Spector, 2001). Learning continues to play a significant role in an architect's career, where architects in most practices engage in CPD (continuing

professional development) events, lunch seminars, and evening training courses typically aimed at improving computer skills, knowledge of new materials/ regulations, or learning about architectural theories, practices and buildings (Kelly *et al.*, 2011).

These values of creativity, continual learning, ethics and social responsibility suggests that architects would be open to learning from how their buildings are appropriated over time. At odds with this assumption is a suggestion that architects have a tendency to disregard the past (Heylighen *et al.*, 2007) and ignore the unknown future. Literature also suggests that most architectural values are based in the visual arena including aesthetics, visual perception and beauty (Senturer and Istek, 2000). Whilst, this dominance of visual values is hardly a surprise considering the nature of architectural work (Till, 2009), the fact that architects ignore time to concentrate on aesthetics and functional performance (Schmidt III *et al.*, 2010) rather than considering how their design decisions impact buildings in use could be because feedback is at odds with key architectural values and practices. It could be argued that if feedback tools could be developed in a way that aligns with these values and modes of operation it could augment current feedback mechanisms and add something that would improve design decisions for adaptability.

FEEDBACK MECHANISMS IN RESPONSE TO ARCHITECTS AND CHANGE

There are feedback mechanisms that can inform every stage of construction (Gorgolewski, 2005). Many feedback techniques focus on the technical performance of a building. A few, for example, CIBSE Energy Assessment and Reporting Methodology (TM22) (Bordass and Leaman, 2005), offer some value to architects, but mainly in terms of identifying when energy improvements could be made in order to meet new, stricter, building regulations. An additional issue with many of these feedback techniques is that data is collected through questionnaires, including the AUDE POE Guide (AUDE, 2006) and Building Use Studies (Leaman and Bordass, 1993), which are aimed at the client and the users' perception respectively. The questionnaire approach tends not to match an architect's agenda as they can only provide surface level detail with no ability to understand why respondents gave the answers they did. This approach tends to deliver generalised feedback that does not provide architects with the type of information they desire (Bordass, 2005). A few feedback techniques have the direct intention of influencing an architect's design decisions, such as DQIs (Gann *et al.*, 2003), soft landings (Bordass, 2005) and AMA work ware (Alexi Marmot Associates, 2008). All three tools take a broader stakeholder perspective, which includes architects, and explicitly attempt to aid future designs by educating all stakeholders on the issues faced by users. They also attempt to amalgamate knowledge at multiple points in time. Thus an examination of these should offer insights into how to improve the integration of feedback focused on how buildings change over time.

The Design Quality Indicators (DQI) survey (Gann *et al.*, 2003) is a user-focused technique that starts as a questionnaire, but also includes workshops that are implemented to discuss issues with the user, in order to gain a fuller understanding of the meaning behind the scores collated. The survey is designed so that these workshops can be conducted at any phase in the project. All phases incorporate most of the main stakeholders, who are brought together to discuss how improvements can be made, allowing for a much broader remit of subjects to be explored. The design

workshop mainly focuses on the needs of the users. The use phase workshop focuses on the impact of the design on the users. During this workshop it is inevitable the changes that have occurred within the building will be discussed, and the reasons for these changes will be explored. However, the focus of the workshop is to understand how to improve the user's environment within the current building for its current use, rather than to specifically understand issues related to adaptability of the building and how an understanding of these changes could potentially improve future adaptable designs.

Soft Landings (Bordass, 2005) is another technique that can be used at any stage from the conception of a building up to, and including, the use of the building. During the briefing phase it is recommended that feedback from existing similar buildings should be used (Bordass *et al.,* 2010), however, this is limited to similar buildings previously studied within soft landings. The final phase is the extended aftercare phase where the architectural aspects are emphasised and fed back. Bordass *et al.* (2010), states that "the design team have found the feedback from students invaluable in considering and developing current school projects with clients, educationalists and users", which shows how invaluable feedback can be to architects. This approach clearly shows how lessons learnt can inform future design decisions, therefore, it is reasonable to assume that, if an explicit understanding of what has changed within the building was added to this already established feedback mechanism, as a separate phase or included in the extended aftercare phase, this could provide a means to improve feedback techniques.

AMA Workware is a feedback mechanism that combines social science techniques with building measurement and analysis, to capture information on the users and buildings to help clients make strategic decisions, mainly by informing design briefs and thereby influencing architects (Alexi Marmot Associates, 2008). It does this using five methods including: questionnaires, space audits, space occupancy surveys, workshops, focus groups and interviews. This feedback technique focuses on allowing clients to make strategic decisions at the briefing stage. Of particular interest to this study, it offers information with regards to change management, however, in its current format this information is only focused on feeding back to clients what changes need to be made in order to get the optimum environment for the current user. Given that it relies on giving the clients better knowledge with which to improve their future briefs, one could argue that it can, in turn, impact the architects (who have to work within these redefined briefs). The reason this could work in a mechanism for feeding information back to architects regarding adaptability is that it is already situated within current modes of practice (defining the brief) and would, therefore, require very little adaptation of processes.

The three feedback mechanisms illustrate some of the more modern methods of feedback, which have evolved away from the traditional, narrowly focused POE feedback tool, and in doing so have come some way to incorporating architects as an explicit benefactor. They all incorporate workshops that bring together the main stakeholders to discuss the building at multiple points in time, from conception through to early use. Adversely, they all stop shortly after the building is occupied and all dissemination is still in report form with very little in the way of visuals. It has also been suggested that the majority of feedback techniques are currently client or user focused (Gann *et al.,* 2003). This is also explored by Gorgolewski (2005) when stating that "feedback is usually focused on business goals rather than design feedback."

A FRAMEWORK FOR ADAPTABILITY

The focus on feeding changes back to the design process is in an effort to better inform design decisions towards a building's capacity to adapt to future changes. This section outlines what is understood as adaptability and presents a framework for how buildings change over time. Designing for adaptability is defined as "a building's ability to accommodate change throughout time, fundamentally extending its life" (Kelly *et al.*, 2011:1). Consequently, an understanding of the configuration of a building and the interactions between its elements can provide insight into how a building will endure and accommodate change (Schmidt III *et al.*, 2009). Conceiving the building as a series of layers provides a way of thinking about the building that links both time and the building's material form as different 'strands' of longevity (Duffy, 1990). Schmidt III *et al.* (2010) expand the concept of layers by conceiving a framework for both designing for and accessing the performance of adaptability within a given context (Table 1). In doing so, they establish a (design-related) framework, for which the table is part of, and uses a series of guidelines and briefing questions to translate the issues concerning the building's capacity to accommodate change into the design process. Whilst not attempting to predict what may happen to buildings, it could simply offer a set of provocations related to each strategy to suggest alternative solutions when designing.

Table 1: Adaptable strategies and layers (adapted from (Schmidt III et al. 2010))

Strategy	Type of change	Building layer(s)	Frequency of change
Adjustable	Change of task	Stuff	High
Versatile	Change of space	Stuff, Space	High
Refitable	Change of performance	Space, Services, Skin	Moderate
Convertible	Change of function	Space, Services, Skin	Moderate
Scalable	Change of size	Space, Services, Skin, Structure	Moderate/low
Moveable	Change of location	Structure, Site	Low

The framework allows for specific examples of change accrued to be tabulated, offering a more nuanced understanding of change. The assumption is that if specific knowledge about the different types of changes is fed back to architects it will enable informed design decisions towards a more adaptable solution, due to a greater understanding of the changes a building can go through over time.

METHOD

The research question posed at the start of this paper was - how can feedback from buildings in use be better integrated into the design process? In order to effectively explore these phenomena it was deemed that qualitative data needed to be collected, in the form of semi-structured interviews. This allowed the flexibility to respond to interesting diversions along with maintaining a robust interview schedule to ensure the data collected was still meaningful (Green *et al.* 2010). The interviews were undertaken with high-level personnel from seven architectural practices. These companies varied from very small (under 10 practicing architects) to very large (over 100 practicing architects). The selection of the practices was based on prior contact. However, despite the convenience of the sample (Marshall 1996), all the interviewees were professionals within the required field and had the appropriate knowledge to be

able to offer insights into the areas identified for the research. The aim was to gain an understanding of how architects currently use feedback or other methods of learning, and to understand how this utilisation could be improved through developing approaches that better reflect architects values. The interviews included a range of questions aimed at uncovering the architects' values and views towards feedback and how these might be better connected with regards to adaptability.

An initial review of the data determined the seven broad themes that were important to the interviewees. Data analysis was done in the form of transcript-based analysis using axial coding. This coding was carried out by the first author of this paper and was subsequently introduced to the other authors iteratively; this was done to maintain consistency of evaluation. From each interview, verbatim quotes were tabulated under the emergent themes as headings, allowing for some cross case analysis of these themes in order to go beyond initial impressions (Eisenhardt 1989).

ANALYSIS AND DISCUSSION

The following discussion explores the critical themes relating to architects views on feedback and architectural values derived from the interviews along with their links to adaptability.

Architectural Values

There were a wide variety of values that were described during the interviews, and the data implies that while architectural practices offer a variety of approaches, all interviewees had similar underlining values.

One of the main values to come out of the interviews was of the desire to design sustainable buildings. Almost all of the architects had an interest in how they could make their buildings more sustainable with current initiatives such as carbon reduction discussed readily. However it was interesting to find that the majority (5 of 7) of architects interviewed were also looking beyond this and expressed that the longevity of buildings played a key factor in sustainability. “There is a definite need to address the existing building stock. And there is a need to understand how to make it last longer.” (Architect C, Very large practice). This expression of the need to find ways to make the building stock last longer was discussed when referring to improving sustainability and hence relates to the feeling of social responsibility expressed in the literature (Spector 2001).

Continuing to learn throughout practice was another key value identified; this is associated with building up experience on projects and the apparent necessity to improve consistently. "I learn from all the buildings that I visit all the time. You know, I go to a museum and I’m learning. I go to somebody’s house I’m learning, so I’m learning all the time"(Architect F, Small practice)

Aesthetics and the use of visuals to communicate, were also recognised as key values that came out of most practices, whether it was using “film to showcase the building to its best”(Architect B, Small practice), or expressing architecture as a “succession of cinematographic moments”(Architect F). Architect F also suggested that the best way to communicate and express uniqueness in design was through models as it showed a lot more than text.

Architects' Views on Adaptability

An architect’s view on adaptability was important in order to test the viability of the adaptability framework to form a basis of any feedback mechanism devised. Most of

the architects agreed that adaptability was on their agenda as they felt it was important to safeguard the future of buildings they are currently designing. "The existing building stock now is a problem. We want our stuff that's being done now to not be a problem in fifteen or twenty years time when it is competing against newer, higher performing buildings" (Architect A, Very Large practice). Architect C suggested that the way they develop adaptability within a building currently, is through close ties with clients and framework agreements so they work with the same client over a number of years on different projects and learn what has worked and what hasn't through continual communication. It could be suggested that a feedback mechanism may enable this communication strand without having a framework agreement with a client as potentially architects could learn how any building has changed over time.

Some of the architects also expressed reservation over making buildings more adaptable as they felt that this meant over specifying buildings, which in turn would add to the cost, and actually make them unsuitable for a specific purpose. "Trying to make buildings too flexible has its own problems. You can make them ultimately adaptable, but they're then not really suitable for the purpose that they're intended at that point in time." (Architect E, Large practice). However, it is felt that with the use of the adaptability framework as a tool to provide a more nuanced understanding of change, makes this view redundant. This will play an important role when suggesting improvements to feedback mechanisms for adaptability.

The Architect's Role

An interesting theme to come out of the interviews was the expressed lack of control on the buildings architects have designed, once it is under construction, and subsequently after it is handed over. This is supported in literature where architects are described as having an increasingly reduced role (Brady 1996). This all has an influence on the type of feedback an architect can gain from the building; it also affects an architect's enthusiasm for feedback, if they have no control over what has been built.

The compelling issue identified within this theme is that the majority of architects have explored the idea of regaining 'power' through knowledge and information. "It's about having intellectual ammunition, having information to support your decision making. This means that clients don't get so hung up on issues if you can explain your decisions and reason" (Architect C, Very large practice). This fits in perfectly with improving feedback, as the more information gained from real project experience by the architect the more justification they can have for digging their heels in over certain issues. "If architects can put that argument across stronger about the value of quality, the value of longevity, the value of good design and flexibility, then, actually, standard design and build will fall away as an unpalatable form of procurement because it's only valuing time and cost."(Architect G, Very small practice).

Poor Utilisation of Traditional (Formal) Feedback

There are a number of reasons as to why feedback is not more extensively utilised in practice. The main reasons are time and money; architects neither have the time nor the resources to carry out post-completion analysis of their design and such analysis is not routinely budgeted for. This is backed up by Eley (2001) who suggests a lack of finance and time as the main reasons for poor utilisation. The few times it is carried out it is at the clients' request.

Some of the formal feedback utilised include the CIBSE TM22, which was seen as good at extrapolating how the building was performing in terms of its energy use. The BUS study was also used by one architect who felt some of the social and building management issues that came up were useful information to feedback into practice. However, the majority of these were undertaken by the client and feedback provided to the architects. Another key theme to come out of the literature is that architects generally do not want to go back or feel that they have to 'let go' (Heylighen *et al.* 2007). This was backed up in the interviews with a number of architects stating the importance of allowing the users to take control, (Architect D, Medium practice).

Another issue to arise was the fact that the form/questionnaire format that comes with the majority of feedback techniques is "boring", due to the amount of closed-ended questions (i.e. suggested answers). Despite these barriers and reservations, all (but one architect) was in agreement that it is important to learn from past buildings and were very receptive to the idea of using a new feedback mechanism to do so.

The Success of Informal and **Innovative Feedback**

Informal feedback is something that is currently used by all practices interviewed, and seems to be the best way to transfer knowledge gained on projects to the wider practice. A lot of this is done in informal evening presentations, weekly meetings or design reviews. "I think as a practice we tend to try and share as much as we can. We have design reviews and try and share the knowledge" (Architect E, Large practice.)

Informal discussions with clients also play an important role in this type of feedback. Architects tend to get to know the client during the briefing and construction phase and it is common to meet them again after completion and, naturally, conversations regarding the completed project tend to take place.

One of the more innovative feedback techniques used in practice was an intranet database of benchmarked office projects to allow designers to see illustrated examples of their current project type, which intern allows them use it to better inform their design decisions on similar future projects. Another mechanism about to be put in place by one practice was a sustainability 'blog', where the entire practice can contribute with anything they may have come across during projects, "We're going to offer the blog to them as a way of people contributing, people that come across things they've learned." (Architect A). This is said to work really well as a simple way for an entire practice to augment their knowledge base; given sustainability is something architects value greatly, it was felt it will be utilised by the majority of the practice.

Informal feedback seems to be the method most used by architects, but this does not provide a way of capturing it for lessons learnt or disseminating it to a wider audience. It is, however, worth noting that an improved feedback mechanism could and perhaps should incorporate some of the informal methods within its delivery.

The Importance of Visual Feedback

Based on the literature, the idea of a visual feedback mechanism was explicitly raised with the interviewees, to examine whether it offered a better match with architects' values. This theme resonated with all the interviewees who discussed it. One architect suggested that they always relate back to plan and elevation drawings, so if there was a feedback mechanism that included these, for example illustrating how the space plan had changed over time, this would be deemed very useful. It was also suggested that the best way to disseminate to practice was through simple graphics that informs the practice in the simplest way possible, as all employees are very busy and always want

information summarised in the shortest form. This will be imperative when suggesting improvements to feedback mechanisms.

CONCLUSION

Feeding back a better understanding of how buildings change over time is arguably crucial to informing architects of how they might improve the building stock and increase its longevity. However, in order for this to have a substantial impact, the feedback mechanism developed has to match the dominant values of an architect, as this has the potential to increase current utilisation.

With an architect's values being dominated by the visual, it seems only right that the most suitable feedback mechanism will also originate in that area. If this is the case, it is suggested that architects would be inspired to use it and proven benefits from lessons learnt would be embraced within the architectural arena. For this reason, one of the avenues to be explored will be the value of developing a web-based tool situated around diagrammatic architectural drawings, photographs and film to further understand how buildings change over time. This tool would come away from the formal feedback mechanisms currently suggested and situate itself within the same category as the blogs and intranets that are currently already successfully in use.

The need for this tool is backed up by the other themes explored within this paper. Architects have an interest in a buildings ability to accommodate change as they understand the need to improve a building's longevity. The architects interviewed also agreed that the more information they can obtain on past buildings the more they can influence the brief and make informed decisions about the adaptability of the design. However, this paper has also shown how poor the utilisation of formal feedback is within architectural practices. There is an urgent need to address this failing through new tools which respond to the needs of architects and their design values.

ACKNOWLEDGEMENTS

The authors would like to thank all the interviewees for their wiliness to participate in the research. This research project is funded by the EPSRC through the Innovative Manufacturing and Construction Research Centre at Loughborough University.

REFERENCES

Alexi Marmot Associates (2008), *Workware Nexus*, AMA, London, UK.

Andreu, I.C. and Oreszczyn, T. 2004, "Architects Need Environmental Feedback", *Building Research and Information*, **32**, 313.

AUDE (2006), *Guide to Post Occupancy Evaluation*, AUDE and the University of Westminster, London, UK.

Bordass, B., Buckley, M. and Bunn, R. (2010), *Soft Landings for Schools*, BSRIA, UK.

Bordass, B. (2005), "Making feedback and post occupancy evaluation routine 2: Softlandings - involving design and building teams in improving performance", *Building Research and Information*, **33**(4), 353.

Bordass, B. and Leaman, A. (2005), "Making feedback and post-occupancy evaluation routine: A portfolio of feedback techniques", *Building Research and Information*, **33**(4), 347.

Brady, D.A. (1996), "The Education of an Architect: Continuity and Change", *Journal of Architectural Education*,**50**(1), 32-49.

Cohen, L., Wilkinson, A., Arnold, J. and Finn, R. (2005), "Remember I'm the Bloody Architect! Architects, Organizations and Discourses of Professions", *Work, Employment, and Society*, **19**, 775.

Cuff, D. (1991), *Architecture: The Story of Practice*, The MIT Press, USA.

Cunningham, A. (1980), "Educating around Architecture", *Studies in Higher Education*, **5**(2) 131.

Duffy, F. (1990), "Measuring Building Performance", *Facilities*, **8**(5), 17.

Eisenhardt, K.M. (1989), "Building Theories from Case Study Research", *The Academy of Management Review*, **14**(4), 532-550.

Eley, J. (2001), "How do post-occupancy evaluation and the facilities manager meet?", *Building Research and Information*, **29**(2), 164.

Gann, D.M., Salter, A.J. and Whyte, J.K. (2003), "Design Quality Indicator as a tool for thinking", *Building Research and Information*, **31**(5), 318.

Glasser, D.E. (2000,) "Reflections on Architectural Education", *Journal of Architectural Education*, **53**(4), 250-252.

Gorgolewski, M. (2005b), "Understanding how Buildings Evolve", *The (2005 World Sustainable Building Conference*, Tokyo, Japan, Sept 27-29, 2811.

Green, S.D., Kao, C. and Larsen, G.D. (2010), "Contextualist Research: Iterating between Methods While Following an Empirically Grounded Approach", *Journal of Construction Engineering and Management*, ASCE, **136**(1), 117-126.

Heylighen, A., Neuckermans, H., Casaer, M. and Dewulf, G. (2007), "Building Memories", *Building Research and Information*, **35**(1), 90.

Kelly, G., Schmidt III, R., Dainty, A. and Story, V. (2011), *Improving the design of adaptable buildings though effective feedback in use*, MISBE, Amsterdam, the Netherlands.

Lawson, B., Bassanino, M., Phiri, M. and Worthington, J. (2003), "Intentions, practices and aspirations: Understanding learning in design", *Design Studies*, **24**(4), 327-339.

Le Dantec, C.A. and Do, E.Y. (2009), "The mechanisms of value transfer in design meetings", *Design Studies*, **30**(2), 119-137.

Leaman, A. and Bordass, B. (1993), "Building Design, complexity and Manageability", *Facilities*, **27**(1), 83-96.

Marshall, M.N. (1996), "Sampling for qualitative research", *Family practice*,**13**(6), 522-526.

Schmidt III, R., Austin, S. and Brown, D. (2009), "Designing Adaptable Buildings", *Harnessing the Power of Information*, South Carolina, USA.

Schmidt III, R., Eguchi, T., Austin, S. and Gibb, A. (2010), "What is the meaning of Adaptability in the building industry?", *16th International Conference on Open and Sustainable Building*, Spain, May 17-19.

Senturer, A. and Istek, C. (2000), "Discourse as Representation of Design Thinking and Beyond: Considering the Tripod of Architecture, Media, Education, and Practice", *Journal of Art and Design Education*, **19**(1), 72-85.

Spector, T. (2001), *The Ethical Architect: the dilemma of contemporary practice*, Princeton Architectural Press, New York, USA.

Till, J. (2009), *Architecture Depends*, MIT Press, Cambridge, USA.

Wang, T. (2010), "A New Paradigm for Design Studio Education", I*nternational Journal of Art and Design Education*, **29**(2), 173-183.