



Post occupancy evaluation in architecture: experiences and perspectives from UK practice

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Published Version

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Hay, R., Samuel, F., Watson, K. J. and Bradbury, S. (2017) Post occupancy evaluation in architecture: experiences and perspectives from UK practice. Building Research and Information. ISSN 1466-4321 doi: <https://doi.org/10.1080/09613218.2017.1314692> Available at <http://centaur.reading.ac.uk/69649/>

It is advisable to refer to the publisher's version if you intend to cite from the work.

To link to this article DOI: <http://dx.doi.org/10.1080/09613218.2017.1314692>

Publisher: Taylor & Francis

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Post-occupancy evaluation in architecture: experiences and perspectives from UK practice

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ABSTRACT

The importance of post-occupancy evaluation (POE) is widely acknowledged in the academic literature, industry press and, increasingly, by professional institutes. Learning from previous projects systematically is central to improving building performance, resulting in a built environment that better fits the needs of clients, end users, wider society and the environment. The key role of architects in pushing forward this agenda has been recognized, however evidence suggests that take up of POE is low across the profession. Whilst research has investigated barriers to POE across the construction industry, very little has considered the unique perspective of architects. In-depth interviews with UK-based architects are presented to explore their experiences in relation to POE and their perspectives on its potential to be a standard part of architectural practice. The findings indicate that a considerable amount of practical work is being undertaken, but uncertainty over what constitutes POE means it is often excluded from the POE label – with significant implications for the development of a rigorous evidence base. An appetite is identified for more holistic evaluation measures that move beyond the current preoccupation with energy efficiency to consider other aspects of building performance, and thereby sustainability, in a wider value framework.

KEYWORDS

architects; architectural practice; building performance evaluation; post-occupancy evaluation; practice-based research; sustainability

Introduction

The construction industry is frequently cited as being inefficient, of poor quality and unable to improve over time (Egan, 1998; Farmer, 2016). Central to solving this problem is the capability to learn from and improve on previous projects as an industry (Bordass & Leaman, 2005; Fairclough, 2002; Morrell, 2015). In this context, the benefits of post-occupancy evaluation (POE) are well-rehearsed. Founded in the need to address the gap in intended and actual performance of buildings (Preiser & Vischer, 2005; Vischer, 2009; Whyte & Gann, 2001), as so starkly revealed in both the Post-occupancy Review of Buildings and their Engineering (Probe) and Innovate UK building performance evaluation (BPE) studies (Bordass, Cohen, Standeven, & Leaman, 2001a, 2001b; Palmer, Terry, & Armitage, 2016), POE has a significant role in improving the products and processes of the construction industry and in ensuring fitness for purpose in terms of environmental and social needs over the long-term (Hartman & Mark, 2013; Mallory-Hill, Preiser, &

Watson, 2012; RIBA, 2016; Watson, Clegg, Cowell, & McCarthy, 2015).

The precise definition of POE is highly contested, with POE being used to address a variety of issues, and embracing a range of methodologies (Hay, Bradbury, Martindale, Samuel, & Tait *in press*). This study adopts a broad two-part definition of POE as both: the process of ascertaining the quality and standards of design and construction (including space planning, resource consumption, internal environmental quality, maintenance and occupancy costs, user comfort, satisfaction and outcomes); and the continual learning and dissemination of POE knowledge in order to shape future architectural projects and practices (Designing Buildings, 2016a).

Within academic research, the post-occupancy agenda is well established and has produced a rich body of work on the complex interactions between design and people in occupied buildings (Jones & Grigoriou, 2014; Watson, Evans, Karvonen, & Whitley, 2016). The design quality literature has addressed a range of outcomes, including

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the impact of design on recovery rates (Ulrich, 2008), end-of-life care (Barnes, 2002; Torrington, 2007) and depression rates in social housing (Wells & Harris, 2007), on attendance (Durán-Naracki, 2008) and learning in school environments (Barrett, Zhang, Davies, & Barrett, 2015), and on satisfaction (Armitage & Murugan, 2013) and productivity in commercial workplaces (Baird, 2010; Leaman & Bordass, 1999). Furthermore, a great deal of applied research has been carried out into the use and value of POE (Deuble & de Dear, 2014; Way & Bordass, 2005), the development of POE methodologies (Candido, Kim, de Dear, & Thomas, 2016; Chiu, Lowe, Raslan, Altamirano-Medina, & Wingfield, 2014; Gann, Salter, & Whyte, 2003; Preiser & Nasar, 2007; Riley, Moody, & Pitt, 2009), as well as the systematic evaluation of a large number of buildings through POE (Baird, 2010; Gupta, Gregg, Passmore, & Stevens, 2015). A wide range of evaluation methods for assessing occupied buildings now exist, including the Probe methodology (Cohen, Standeven, Bordass, & Leaman, 2001), design quality indicator (DQI) (Gann & Whyte, 2003) and Achieving Excellence Design Evaluation Toolkit (AEDET) (Ruddock & Aouad, 2009). However, there is little evidence that this body of research has transferred to the practice environment to close learning loops and ensure future projects are informed by a joined-up evidence base rather than the isolated experience of individual professionals (Henderson, Ruikar, & Dainty, 2013; Kelly, Schmidt, Dainty, & Story, 2011; Leaman, Stevenson, & Bordass, 2010; Preiser & Vischer, 2005; Stevenson, 2009; Stevenson & Leaman, 2010; Vischer, 2009; Whyte & Gann, 2001).

POE is currently being incentivized in a number of ways. In the UK the incorporation of the principles of government Soft Landings within BIM (building information modelling) Level 2 through Building Standard 8536-1 gives a clear signal of a wider recognition of the value of the integration of POE in the procurement process (Hay et al., 2017). In addition, incentives arise from the development of new and existing international standards such as the WELL Building Standard¹ and Passivhaus,² which depend upon POE for certification. Building Research Establishment Environmental Assessment Method (BREEAM),³ Leadership in Energy and Environmental Design (LEED) (Huizenga, 2005), and the Green Building Council of Australia Green Star⁴ all give credit for the use of POE. Market and regulatory emphasis on performance in rating tools such as the National Australian Built Environment Rating System (NABERS) for energy efficiency, water usage, waste management and indoor environment quality forces building owners to undertake partial or comprehensive POE studies of their buildings.⁵

Despite the existing knowledge and regulatory support for its take-up, Cooper's (2001) question, 'Post-Occupancy evaluation – where are you?', remains highly pertinent today. Within architecture – the field on which this article focuses – surveys indicate that take-up is very low, with only 3% of British-based architectural practices regularly undertaking POE on housing projects (Clark, 2015), only 9% of chartered practices offering POE to clients, and none generating revenues from POE services (The Fees Bureau & RIBA, 2015). This is despite recent evidence of a willingness and desire amongst British architects to undertake research and evaluation in practice (Dye & Samuel, 2015; RIBA, 2014). This evidence chimes with the experience of architects in North America (Hiromoto, 2015) and in Europe where the development of POE in architecture is also on the agenda (ACE, 2014).

It is recognized that POE delivers tangible value to architects, both in improving the services and products they deliver (Preiser, 2003), but also as a means through which they can evidence the benefits of investing in high-quality design to clients and wider society (Hay et al., *in press*; Kelly et al., 2011; Leaman et al., 2010; Macmillan, 2004, 2006; Samuel, Awan, Butterworth, Handler, & Lintonbon, 2014). As a result, architects have an important role to play in advancing POE to become a widespread and consistently embedded aspect of standard practice in the construction industry. Indeed, the promotion of POE in architecture is the subject of a two-year strategic push by the RIBA Research and Innovation Group (RIBA, 2017). It involves a call for evidence aimed at architects actively involved in the research and evaluation of their work (RIBA, 2015), a report based on practical case studies of how POE is effectively used by architectural practices in conjunction with the current authors (Hay et al., *in press*), and an investigation into the relationship between research, personal indemnity insurance and building warranties (RIBA, 2016).

The research to date on POE in architecture has been drawn from high-level surveys (The Fees Bureau & RIBA, 2015) and large research programmes (Bordass et al., 2001a, 2001b; Palmer et al., 2016). These studies provide evidence that POE is not happening in practice, but do not explore the qualitative reasons why. Nor do they reveal the detail of approaches taken by architects, how they understand and develop their interest in POE. This paper seeks to contribute to this gap in knowledge by revealing the barriers and potential solutions to rolling out POE more widely within architecture (Hadjri & Crozier, 2009) through an in-depth qualitative exploration of the attitudes and perspectives of practitioners themselves (Gupta, 2014; Kelly et al., 2011).

Table 1. Research participants.

Pseudonyms	Role	Organization	Location of operation
P1	Research and sustainability lead	Large architecture practice (50+ employees)	International
P2	Partner	Small architecture practice (6–10 employees)	South East, UK
C1	Senior lecturer, sustainable design	University	UK
P3	Research and sustainability lead	Large architecture practice (50+ employees)	International
P4	Partner	Medium architecture practice (11–50 employees)	UK
P5	Director	Large architecture practice (50+ employees)	UK
P6	Research and sustainability lead	Large architecture and engineering practice (50+ employees)	International
P7	Research and sustainability lead	Large architecture practice (50+ employees)	International
P8	Director	Medium architecture practice (11–50 employees)	North of England, UK
P9	Partner	Large architecture practice (50+ employees)	International
C2	POE/BPE consultant	Independent	UK
P10	Director	Micro-architecture practice (0–5 employees)	North West, UK

Note: BPE = building performance evaluation; POE = post-occupancy evaluation.

Methods

This paper draws on qualitative research undertaken between June and September 2016. The project involved 10 in-depth interviews with architects based in the UK, five of which also operate internationally (Table 1). These were supplemented by two additional interviews: one with a lecturer working in architectural education and the other with an advisor in POE and BPE. Whilst the sample is small and does not represent all architectural views either in the UK or internationally, it does offer a unique and in-depth account of the critical issues faced by practitioners who are already active in POE. Participant recruitment was based on purposeful rather than statistical sampling logics (Stake, 2005; Yin, 2003), with the identification of interviewees likely to provide pertinent and timely information about POE. Interviews were undertaken with senior architects already active in the world of POE, based on a review of industry and academic literature and a call for evidence undertaken as part of the RIBA's Design Quality and Performance review (RIBA, 2015). The interviews were carried out face-to-face or over the phone and were semi-structured to allow for a 'certain degree of openness of response' (Wengraf, 2001, p. 62). Three broad areas were defined in order to frame discussions, but participants were free to explore areas of relevance and import to them during the interview:

- experiences of implementing POE and the barriers faced
- potential solutions to embedding POE more consistently
- future directions of POE research in architectural practice

The interviews lasted between one and two hours, were transcribed anonymously and respondents were

assigned pseudonyms (P1–P10; C1–C2) to ensure participant confidentiality (Table 1).

A grounded theory approach to data analysis was adopted, facilitated through the use of HyperResearch,⁶ a qualitative data-analysis software package. Grounded theory offers a way to develop an understanding of POE in the terms defined by research participants themselves, rather than imposed by a set of predefined measures or theoretical frameworks (Charmaz, 2006). This also means that the research findings are presented in terms that are understandable and actionable to both the academic and practitioner audiences. This is firmly within the tradition of applied research that aims to be impactful and relevant to the world outside the academy (Pacione, 1999). A way of doing research that is also at the heart of POE – a practice that necessarily spans the traditional boundaries between academia, industry researchers and practitioners (Allen, 1998; Bachman, 2013; Duffy, 2008).

The paper is structured around five themes identified through the analysis of interview data – defining POE, valuing POE, barriers to POE, embedding POE and developing POE – and are dealt with in turn below.

Defining POE

From the research, it became evident that there is currently no single, shared definition of POE amongst the research participants. Interviewees agreed that POE was fundamentally about 'understanding how the building is performing when finished, and the experience of building users' (P2), both good and bad, so that 'the next project learns from it' (P4). For some the terminology of POE was less important than the practice of asking whether a building works as intended: 'we have been doing that for a long time, it's just not been called

POE' (C1). Four interviewees echoed debates in the academic literature that has seen a move from POE to BPE (Preiser & Nasar, 2007). BPE was seen to 'sit over the top of POE' (P1), encouraging a 'lot of thought upfront and reality checking through the process', as well as the upstream use of knowledge that can then be integrated directly and used to 'refine future designs' (C2). Those who subscribed to the BPE ideal described it as a holistic 'philosophy' or 'ethos' based on 'continuous learning' (C2), rather than an isolated activity. It was also seen as a way to move away from the assumption that evaluation takes place 'in the building when it is built', rather than embedding performance evaluation 'at the start' and ensuring that you 'follow it through' (P7) at every stage, and in subsequent projects. As one architect described:

the problem with POE is that it assumes a stopping point rather than reviewing the life of a building. We are moving to a constant feedback loop in our work. (P8)

Whether defined as POE or BPE, the substantive focus of research and the methods utilized by participants varied depending on the particular project or building type. Whilst all recognized the importance of understanding energy and carbon use as a baseline, most went further than this (or at least had ambitions to do so), for example, in seeking to understand a wider range of impacts including comfort (P7), satisfaction (P1), productivity (P4), learning (P5) and wider community benefits as a result of engagement in the design or build process (P2). They also employed a range of methods and toolkits including sensors and monitoring (P5), user surveys (P1), building walkthroughs and observations (P8), focus groups and interviews (P10), as well as visual and participatory tools (P2). Evidently, there is a diversity of approaches to POE in practice that cannot easily be reduced to a simple definition. This very slipperiness in the reality of POE implementation, as opposed to static terminologies or toolkits, appeared to be of benefit to architect-practitioners who creatively adapt their approach according to particular project contexts.

Valuing POE

All the participants interviewed for the study recognized the importance and value of POE to their practice, wider industry and the long-term quality of the built environment. This appeared to drive the motivation for doing such work rather than meeting prescribed regulations, codes or contracts. This is unsurprising considering that the participants identified for the study were approached because they are already engaged in POE.

Interviewees were well aware of the low take-up of POE within the architectural profession and across the construction industry as a whole, commenting that other design industries have a better culture of 'reviewing how a product is made and how they meet customer requirements' (P4) and that 'no other industry spends as much as we do and doesn't evaluate it effectively' (P3). The implications of the low incidence of POE were clearly articulated, with all interviewees highlighting the persistent gap in the design and performance of buildings in terms of energy use, carbon emissions, occupant comfort and satisfaction. The integration of feedback into practice was viewed as central to understanding and addressing this 'performance gap' (P2).

POE was also seen as key to making the case for investment in design to clients and wider society. This was seen to be important at the level of individual practice where POE could help evidence claims to particular expertise or building specialisms, *e.g.* community-led projects (P2) and Passivhaus standard design in public buildings (P5). It was also seen as crucial in raising the standing of the profession as a whole. As one participant commented:

it is really important for architects to be seen to be designing from evidence to show that design is fundamental to the success of a project, rather than the mystery of design as a magical creation which is seen as a 'nice-to-have'. This is part of a broader agenda to illustrate the value an architect can add; as a profession it is what we should be doing to make our case for the importance of good design. (P4)

Barriers to POE

Participants in the study were aware of the fact POE has low buy-in across the construction industry. As one interviewee stated,

POE has been kicking around since the 1960s and there is a reason it doesn't happen. We have been saying that now is the time for POE for a long time! (P1)

Even within their own practices, where the benefits of POE are understood and promoted, interviewees reported that POE could only be completed on a project-by-project basis rather than as a routine part of all work undertaken: '[i]t should be central to our practice, and we really do try, but it's difficult to carry out POE on every project' (P4). Whilst problems with the culture and attitudes of some architects were identified as an issue, *e.g.* complacency (P9, C2), and lack of understanding about the benefits of probing the project in-use to reveal things that would otherwise be left unknown (P9), the major issues identified were industry wide. These include structural factors in the construction sector, insurance

and liability issues, deregulation, and the need for robust support from the professional institutes.

Structural factors in the construction sector

Whilst education and up-skilling were seen as important factors in addressing the low take-up of POE, it was wider problems relating to the structure of the construction industry that were seen as fundamental, rather than the behaviour of individual architects. These include the ‘terrible psychology of short-termism’ (P5) that is seen to beset an industry driven by quickly realized profits, and efficiency savings in the construction process, rather than long-term benefits to clients or wider society – ‘the primary time and budget drivers override everything else’ (C2). Whilst POE is seen to be fundamentally about ‘improvement and quality’, the market for ‘building does not depend upon this’ (P10). For example, one participant cited the housing market where there is a shortage of stock and high demand as an example: ‘there is no driver to build better homes, because we just need more of them’ (P1). In a commercial context, another argued that quality ‘may not be a sufficient premium in the eyes of buyers because performance tends to be less important than location’ (C1). With another arguing that when building large office developments in areas with a high land premium, ‘the amount spent on things like energy costs may be negligible’ and therefore not worth tackling in the context of ‘huge capital budgets’ (P5). In these cases the focus tends to be on ‘quick construction and on a short moment when the building is completed and handed over’ (P2), a factor that was seen to run counter to the fundamental philosophy of POE (C2).

Two interviewees identified this as a particular problem when working with speculative clients who ‘sell on quickly and move on’ (P6) with little interest in understanding ‘how a building behaves in use’ (P8). It was also seen to afflict public sector construction, but to a lesser degree, as a result of a rise in design-and-build contracts that ‘put contractors in the driving seat, and for whom success and failure depends on clawing back small margins’ (P10). In the procurement of schools, for example, one interviewee argued that whilst the architect and client may want to invest in high-quality design to boost health, wellbeing and academic attainment outcomes for school children, it is ‘costs and procurement [that] are up-front in the building process’ (C1). In this context ‘POE is often not even on the radar of most clients’, they do not see or understand ‘its value’ (P10) and ‘more often than not, don’t want to pay for it’ (P3).

The rise of contractor-led building projects was also seen to have a direct impact on the architect’s position

in the project team, and their ability to take the lead in promoting and carrying out POE. In these contexts interviewees reported that they are rarely involved at all stages of a project, had limited direct contact with clients and users, and less strategic input into briefing and handover. Further, in a context where the architect may not have control over final quality, and lines of accountability are blurred, one participant argued that it may not be in their interest to push for POE: ‘we may not want to lift the lid on finished projects’ as ‘there is a fear of being drawn into complex situations [where we] don’t have an awful lot of [agency]’ (P5). For example, the design brief may not be forward thinking enough to consider how a building might change over time:

after six weeks an office is being used by 150 rather than 100 people – the space should be adaptable of course – but the architect doesn’t want to be blamed for use of a building that has changed. (C1)

Even when contractors do take custody of evaluation at the higher management level, one participant argued that those:

delivering projects may feel it is a blame game. They have been under a lot of pressure to get a project done, and within budget which is the primary driver and then feel they are being scrutinized unfairly post-completion. (P1)

Insurance and liability

There is a connection here to concerns over liability and reputation if negative findings are exposed as a result of evaluation which can be, in the words of one participants, ‘poisonous both commercially and professionally’ (C2). Three interviewees reported that they would only attempt to carry out POE with clients with whom they had a particularly good relationship:

obviously we wouldn’t work with particularly litigious clients. We wouldn’t want to give them potential ammo [ammunition] to hit us with ... it has to be the right client. (P1)

This was related to a concern that POE could focus on the negative aspects of a project at the expense of positive outcomes (P1). The potential of POE to unearth negative findings was seen to be a particular problem from an insurance point of view: ‘insurers have been worried that POEs increase professional indemnity (PI) risks’ (P7). In fact, the attitude of insurers was seen to be a fundamental challenge for architects engaging in project evaluation despite the fact that the evidence indicates that POE ‘is likely to lead to better buildings’ (P7) and so potentially reduces risk over the long-term. One participant pointed to the need for new forms of insurance

that supported a greater role for POE research and evaluation: ‘we definitely need the ... legal product[s] in place to be able to work in this way’ (P8), with another arguing that ‘insurance needs to open up, if they don’t it’s quite tricky’ (P1).

Alongside a need for insurance that is fit for purpose, three participants expressed the need for new forms of contracts. Traditional and design-and-build were seen to act in ways that were counter-productive to POE. Very few contracts allow architects and the wider design team the opportunity to return to a project post-completion, with a loss of ‘all control of gateways to the building’ (C1). According to interviewees, this not only provides practical challenges for architects to gain access to building users but also sets up a structure that encourages the quick movement from one project to the next with no time to reflect and learn:

this makes it difficult to have a connection with the end product that we are producing and to be accountable to what is happening in use. (P5)

Contracts were seen to be severely prohibitive, running counter to the ethos of BPE, with the most prevalent forms of contracts disincentivizing returning to a project, and a fear of blame and liability for failures (P5, C2).

Deregulation

The responsibility of policy-makers to promote POE was also discussed. Whilst POE has never been mainstream, two participants felt that during the 2000s government appeared to take the lead by supporting its use through legislation (P4, C2). The retreat from standards such as the Code for Sustainable Homes (Planning Portal, 2008) and Zero Carbon Homes (Designing Buildings Wiki, 2016b) was seen to represent a move away from direct regulation of the private sector to ‘client lead and demand’ (P4). Private-sector organizations such as the Building Research Establishment (BRE) were seen to take a key role in generating demand, but there was a concern expressed that the piecemeal adoption of POE methods was not good enough and would not counter the wider drivers shaping construction in the UK:

it’s a real shocker that it has fallen to private enterprise to pick this up ... it has to be beyond the good will of individual architecture practices and M&E [mechanical and electrical] engineers. (P1)

One participant felt that existing standards and tools such as BREEAM (BRE, 2017) and the Home Quality Mark (BRE, 2015) were useful for enabling ‘a conversation with the client’ providing ‘a basis on which to

develop a dialogue ... to convince them of why it should be done’ (P8), but that there was a need for robust public sector measures:

if the government said you must do this and certify your buildings, we need some sort of stick and carrot, we have the techniques to evaluate, but no incentive. (P8)

This was supported by three further interviewees who argued that government ‘needs to take the lead’ (P5) because when POE is optional it is likely to become a ‘tick box exercise’ that is seen as a ‘luxury rather than ... [a] necessity’ (P4), or at worst an ‘extra bit of funding ... to support rather than a benefit’ that can be ‘value engineered out’ (P1). In order to give existing standards ‘more bite’, interviewees felt that POE should become a requirement through the planning system so that it ‘is no longer a nice-to-have, and becomes a cost of the project like any other aspect’ (P4). Another outlined that:

if government bodies were prepared to put a bit more money in, and have a longer term environmental strategy, this could go a long way. (P5)

One participant argued that POE should be mandatory on publicly procured projects:

We have long argued that public sector clients should be obliged to share information, warts and all, because it’s tax payers’ money. There should be transparency. So perhaps they should be forced to share information about the buildings they procure. (P4)

Need for institutional support

Recognizing that the political trajectory was not likely to move in the direction of regulation, participants felt that the professional institutes need to do more to promote POE. Five interviewees argued for stronger leadership from the Royal Institute of British Architects (RIBA), with two arguing that initiatives to make POE a priority had not been promoted vigorously enough. In particular the inclusion of *Part M: Feedback* in the RIBA Plan of Work⁷ was identified as needing more support from the institute to ensure its widespread adoption (C2, P1).

The publication of better and more accessible information by all the professional institutes was seen to be desirable, including guidance covering POE case studies, signposting to existing methodologies and toolkits (C1), examples of POE clauses for different types of contract (P1), alongside the incorporation of POE into judging criteria for design and construction awards (P7). The institutes were also seen to have a key role in promoting the findings from POE research to ensure knowledge is shared. One participant argued that because building cycles are very long, and staff and expertise change

from one project to the next, a concerted effort must be made to capture learning to prevent repeat mistakes (P6). As another said, ‘there is such a leakage of knowledge, it is painful’ (P8). Participants felt the professional institutes could do more as a conduit for the sharing of information across individual offices, and academia for the benefit of the profession (P4) and the wider construction industry (P6).

Embedding POE

Despite some significant limitations to the effective implementation of POE reported, many participants were keen to share how they have been able to embed POE in their work. Whilst POE is not carried out on every project, a number felt they were making good progress in that direction, saying: ‘we are getting there – we are finding our feet’ (P1) and ‘we have carried out POE over the last seven or eight years as a way to develop practice knowledge’ (P5).

Funding POE

One of the key findings was around the funding of POE and participants reported that they had found a variety of ways to resource it. Larger offices had developed the infrastructure to support POE with the appointment of full-time researchers and sustainability advisors (P1) to carry out POE work, develop in-house methodologies (P7), and to collaborate with universities to ensure that ‘cross-project learning and knowledge from POE is fed into future work’ (P3). When fees were not available to pay for POE many of the participants recognized that it was ‘still worth pursuing from an organizational point of view’, particularly when clients ‘think it’s a good idea but do not have the resources to pay’ (P2).

Within larger organizations it was possible to ‘absorb the overheads to some extent because of our size’ (P3). Another participant noted that although money is lost on POE, it is seen as an ‘investment in a relationship with a client, or for internal learning’ (P6).

Architects working in small to medium-sized practices used tactics such as the designation of research leads in practice and working groups focused on research and development to promote the use of POE (P4). Participants reported that even a light-touch POE is ‘better than nothing’ and that such approaches happen frequently but tend not to be communicated or valued (P6). For example, lessons-learned visits, outlined by a participant below, may not be labelled as POE but are nevertheless useful to practitioners and clients:

The pattern is usually the same, it involves the whole office participating in a site visit where we ask the client and users to participate in a walk around the building. We then sit down, and discuss what we have seen, invite other people into the building to talk to us, including landlords and tenants for example. We take copious notes, discuss it in the office, and review these findings against the projects that are currently on the drawing board. The aim is that the learning is fed right back into our work. (P8)

Participants stressed the importance of being proactive in developing POE through a range of funding opportunities, particularly in partnership with academia. One interviewee stressed that they have:

collaborated with universities quite a lot, both as part of large funded programmes of research ... but also on one-off research projects, as well as work with post-graduate and PhD students. (P2)

Developing links and funding bids with university researchers was seen as a good way to identify resources, as well as accessing academic expertise to help develop rigorous and ethical POE methodologies and modes of analysis (P5, C2).

Client-led POE

Whilst much of the POE work undertaken was via a ‘mix and match’ (P10) approach drawing in resources from various sources, participants were buoyed by their experience of working with clients who saw the value of POE and were willing to pay for it. They outlined working with ‘some very enlightened clients who understand the benefit of POE to the building and its potential in making it work better’ (P8). These clients were described as having a culture of ‘openness and trust’, and less worried that negative findings would be ‘exposed and unearthed’ (P1). According to participants, these clients are often those with a ‘long term interest’ (P4) who intend to retain ownership of a building, including universities (P4), housing associations (P2) and public-sector clients (P5), as well as businesses that take seriously an obligation to their staff to provide healthy and fit-for-purpose working environments (P3). Participants also cited examples of working with forward-thinking high-end commercial developers and landlords who have come to see POE as a way to ‘de-risk the next project’ (P1), and understand that enhanced building performance could improve their relationship with the building occupier (P6).

Increased appetite from clients has led some practices to offer POE as part of the architectural services provided: ‘we have started to build it into our fee’ (P1). However, the focus of this kind of POE business was

reportedly concentrated on existing clients where a productive relationship already stands. This is because it is repeat clients who see the tangible benefits of POE from one building to the next. For example, one practice developed a long-term collaboration over a decade with a client, delivering improvements in performance through tweaks to building management in-use, and changes to the design in each project iteration (P5). POE was offered on the basis of mutual interest, as ‘we would get continual feedback, whilst also providing support on an operational basis including maintenance and latent defects that might occur’ (P5). Clients who had been through the process of POE and seen improvements in building performance as a result were enlightened to the fact that investment in POE research is worthwhile. One architect explained:

the clients we have engaged with have seen the benefits. One client has taken on POE and has repeated work on their project, others have integrated new management strategies into their buildings as a result. (P3)

The focus on evidencing improvement through POE has also led to the development of new contracts with clients based on performance (P5, P7, P8). For example, one architect had developed a long-term partnership with a developer which includes a profit-sharing relationship if building performance improves from one development to the next:

In these ongoing projects we are creating a complete feedback loop with outputs on building performance including energy and user feedback fed into future work. If we achieve more and push the performance further we share in profit with the developer for delivering on all aspects – performance, innovation as well as commercial. We invest a lot of time on these projects in thinking, discussion and reflecting but it is worth it and not too risky because our fees are guaranteed because of the ongoing work with this particular client. (P8)

The success of these long-term projects in pushing up quality has not just depended on a good relationship with clients, but also the wider project team (P6), including ‘other consultants, contractors [and] sub-contractors’ (P5). Stability in the team of designers and contractors, with a proven track record, experience of working well together and able to learn from project to project as a ‘conscious process’ was seen to have ‘huge benefits’ (P5).

We try and build relationships with other consultants so the same team can work together again and again. ... You don’t start from zero learning on every project and you are beginning to build up a particular knowledge base so you transfer all that knowledge and skill. I think we all know that the whole process is about collaboration, it is not about the architects on their own

solving the problem. It is about working as a team, and wanting to collaborate across the design professions. (P4)

Engaging users

For some of the architects interviewed, collaboration in POE went beyond the immediate project team to embrace building users, based on a belief that it is impossible to understand how well a building is performing without ‘understanding the way people really use buildings’ (C1). Investigating how occupants experience and use a space was reported as ‘illuminating’ (P10), often revealing ‘something different ... that you just didn’t expect’ (C1).

Close collaboration with the client and building users was also seen as a way to ensure that the POE focused on the particular priorities of a project, rather than on generic issues. Participants argued that POE should drill down into the key objectives or outcomes agreed at the briefing stage, and should be ‘linked to the design intent’ (P6).

I have learnt that every building is different, there is no one-size-fits-all standard of POE. I used to think there was, but there isn’t. You have to measure particular, targeted and specific things to make it useful. ... It’s also crucial that the project context is taken into account so you understand the constraints of a project. (P4)

This point translates into the different types of methodologies that were reported by the interviewees. Whilst off-the-shelf toolkits were recognized as being useful, there were also evident downsides in adopting a generic approach that may not be suitable to particular contexts or building types (P1).

Developing POE

Whilst recognizing the importance of the continued development of POE to address energy efficiency and fabric performance in building stock, many of the participants stressed the need to move beyond a perceived ‘bias toward the technical’ (P10) and consider broader aspects of sustainability. While one respondent reflected that in the ‘early days of POE the emphasis was on energy, including energy use and air tightness, as well as building user surveys’, there has been a move to broaden the analysis in order to understand ‘the way people use and behave in space’ and its impact on building performance (P4). The focus on user experience, opinion and behaviour has led some of the architects interviewed to look beyond energy to consider more fundamental questions about the sustainability of the built environment. A key point of interest was to question

whether an energy-efficient building can be seen as ‘green’ if it is not adaptable to changing uses, or is unpopular with users and the wider community:

We are very interested in the robustness of buildings that makes them useable in the future ... so this is looking at slightly different questions: will the building last, what’s the point of energy use if you can’t change it in the future? (P4)

What if you make a green building that people hate? The social knock-on effects of a horrible building that impact negatively on occupants may be more important than energy use. (P1)

From this perspective a good building is not defined by how much energy it uses over its lifetime, but must be judged on the fulfilment of its main function: a space and place for people. One architect argued, ‘you have to remember the primary objective of a building. It is a home that must meet a certain set of needs’ (C1). As a result, POE needs to build on the monitoring of energy use and internal environmental quality, go beyond narrow surveys of satisfaction, and address a wider set of issues and questions. The architects interviewed discussed a range of ideas, including how investment in office design offers financial benefits related to absenteeism, wellbeing and performance:

we are interested in making connections through data on sick days, for example. ... Staff costs to a client are really high. ... When you actually look at health and productivity, and even happiness, you understand the longer-term value of investment in good design. (P4)

Another point of interest was the impact of school design on learning and behaviour outcomes for schoolchildren:

the headteacher said there was a real difference in how children behaved in the building. It was quiet and peaceful and they even used it to calm kids. It would be great to be able to understand such effects better. (P2)

Other suggestions include the impact of retail design on sales figures (C1), making the links between hospital design and the stress levels, wellbeing and recovery of patients (P1), and understanding the potential for the involvement of participants in the design and construction process to produce positive outcomes, for example, through self-build (P2).

Although the architects interviewed for this study have started to develop an understanding of the importance of these questions, their thinking tends to be based on anecdote rather than sustained research, and few referenced the wide range of relevant scholarship already developed within the academy (Watson et al., 2016). Participants also expressed frustration with existing POE toolkits that appear to favour quantitative measures that capture

the ‘headlines’ (P10), but do not delve into the experiences and feelings of building users or participants. As one interviewee explained, the ‘qualitative aspects may be difficult to measure, but they are crucial if we really want to understand the buildings we make’ (P2). A focus on these wider impacts, embracing not just quantitative or technical aspects, but also how a building works in spatial, social and cultural terms, was seen to be the unique contribution that architects could bring in developing the POE agenda. The exploratory nature of architectural practice was considered a positive, giving the profession an aptitude, willingness and openness to ‘explore ideas that are both cultural and technological’ (C2), as well as a set of creative and engaging approaches to POE based on ‘visual tools and mapping’ (P1). So, whilst engineers and surveyors were considered more naturally inclined to focus on quantitative aspects, architects were seen to have ‘very different priorities’ (C1) and a capacity to take a broader view: ‘we are committed to creating places for people, place-making with people at the heart, rather than just thinking about “the building”’ (P4).

Discussion and conclusions

In the context of the professional institutes (RIBA, 2016; Watson et al., 2015), researchers (Bordass & Leaman, 2005; Guerra-Santin & Tweed, 2015; Preiser, 2003) and teachers (SCHOSA, 2015) calling for POE to become more widely employed in the construction industry, this paper has explored the unique perspective of architects themselves. The thematic evidence drawn from interviews with UK-based architects with an existing interest in POE has revealed a number of common perspectives, experiences and issues relating to POE in practice. It is apparent that POE is valued by this practitioner group as a useful and informative exercise. Yet, they experience a number of problematic issues in its delivery, mainly concerning structural elements of the construction industry, such as speculative clients, design-and-build contracts, the diminution of the architect’s authority in the design team, and insurance and liability issues, especially apparent in relation to profit-driven, short-termism which has limited time and resources for POE activities. They have highlighted that the current operation of the construction industry does not incentivize the improvement of buildings over time, yet POE is founded on continuous learning and improvement over the long-term. The market failure of the construction industry has not been addressed in the wider political context either, where a lack of regulatory support for POE through compulsory standards and legislation, and limited action from the professional institutes is

seen to hinder its potential diffusion (Chiu et al., 2014; Göçer, Hua, & Göçer, 2015; Hadjri & Crozier, 2009; Preiser, 2001). Interviewees argued for a greater role for the built environment institutes and industry bodies in order to pool resources and share information and findings from POE research. The use of POE can serve two strategic purposes: as a way to support improvement in the quality and long-term sustainability of the built environment and for architects to make a claim to legitimacy by evidencing ‘the usefulness of the profession for the public advantage’ (Hughes & Hughes, 2013, p. 34).

The experiences of the architects in this study highlight the variety of ways in which individual practices find ways to engage in POE-related activities. Larger practices recognize the commercial benefits of research and evaluation, and resource professional researchers to work across their organizations using overhead budgets. Smaller practices seek to raise the profile of research in practice through working groups and designated research leads. Practices of all sizes recognize the benefits of POE-related activities, *e.g.*, ‘light touch’ project visits and walkthroughs with clients and users, and have worked to ensure learning from these sessions are fed back into the organization to inform future work. Finally, the examples of long-term collaborations, the emergence of performance-related contracts with engaged clients, and development of close-knit project teams of consultants and contractors all evidence the different ways that practices and practitioners have forged ways to embed POE in their work.

The findings have also illuminated some interesting questions in relation to how POE is defined, what it is taken to include and exclude, and how these conceptualizations impact architects’ understanding of their own involvement in POE activities. Many of the practitioners involved in this study undertake various forms of project evaluation, such as follow-up visits, that they do not consider to be POE in its formalized definition. They also have varying interpretations of what constitutes POE, and use it for different purposes and in different ways to suit varying project contexts. The participants in the study were particularly interested in developing POE methodologies that cover aspects of building design that are not currently captured by off-the-shelf toolkits (Kelly et al., 2011). Measurements of carbon emissions and occupational comfort are only a baseline for practitioners whose interest extends to a broader understanding of how buildings work for their clients and, ultimately, the communities they have been designed for. For example, the impact of school design on learning, the process of self-build on community cohesion, and the links between the design of healthcare buildings on patient comfort and stress. Amongst this small cohort

of respondents, there is an appetite to understand how POE methods can be stretched to embrace these broader and longer-term building impacts (Duffy & Rabeneck, 2013). These aspects have been drawn out in the academic literature, but seem not to have been translated into practice. The divide between practice knowledge and the academy appears to remain intact (Allen, 1998; Duffy, 2008). There is clearly a need, as Duffy (2008) argues, to undertake some of the challenging work of engaging social scientists to ‘check the validity of design propositions’ and ‘combine scientific, technical and moral (not to mention aesthetic) issues’ in building investigations to ensure that research findings are not ‘banal, suboptimal and incomplete’ (p. 656). Such an endeavour could also help answer calls to redress the balance of existing POE research away from short-term technical and cost aspects to longer-term values, including the interaction of the built environment with social, cultural and environment aspects of sustainability (Alker, Malanca, Pottage, & O’Brien, 2014; Chiu et al., 2014; Duffy & Rabeneck, 2013; Stevenson & Rijal, 2010).

Notes

1. See <https://www.wellcertified.com/>.
2. See <http://www.passivhaus.org.uk/>.
3. See <http://www.breeam.com/>.
4. See <http://new.gbca.org.au/green-star/rating-system/>.
5. See <https://nabers.gov.au/public/webpages/home.aspx/>.
6. See <http://www.researchware.com/products/hyperresea rch.html/>.
7. The RIBA Plan of Work sets out the key stages of building projects – including briefing, design, construction, maintenance, operation and use – as guidance for chartered UK architects to prepare professional services contracts (RIBA, 2013).

Acknowledgements

This project was undertaken as part of the University of Reading’s Value of Architects project. The authors would like to thank the project advisory group for all their help and guidance. Special thanks goes to all of the research participants involved in the study for their generous contribution of time, and for sharing their thoughts and experiences about the realities of POE in practice. Finally, the authors are also grateful to the anonymous reviewers and the editor for their useful comments.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Arts and Humanities Research Council (AHRC) [grant number AH/M008274/1].

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References

- ACE. (2014). Policy positions: Responsible architecture. Retrieved from <http://www.ace-cae.eu/80/>
- Alker, J., Malanca, M., Pottage, C., & O'Brien, R. (2014). *Health, wellbeing & productivity in offices: The next chapter for green building*. London: World Green Building Council. Retrieved from http://www.worldgbc.org/files/6314/1152/0821/WorldGBC__Health_Wellbeing__productivity_Full_Report.pdf
- Allen, W. (1998). Forum: The conduct of building research. *Building Research & Information*, 26, 374–382. doi:10.1080/096132198369724
- Armitage, L., & Murugan, A. (2013). The human green office experience: Happy and healthy or sick and frustrated? *Australian and New Zealand Property Journal*, 4, 35–41.
- Bachman, L. R. (2013). New professionalism: The post-industrial context. *Building Research & Information*, 41, 752–760. doi:10.1080/09613218.2013.804778
- Baird, G. (2010). *Sustainable buildings in practice: What the users think*. London: Routledge.
- Barnes, S., the DESIGN IN CARING ENVIRONMENTS STUDY GROUP SARAH. (2002). The design of caring environments and the quality of life of older people. *Ageing & Society*, 22, 775–789. doi:10.1017/S0144686X02008899
- Barrett, P., Zhang, Y., Davies, F., & Barrett, L. (2015). Clever classrooms. Retrieved from <http://www.salford.ac.uk/cleverclassrooms/1503-Salford-Uni-Report-DIGITAL.pdf>
- Bordass, B., Cohen, R., Standeven, M., & Leaman, A. (2001a). Assessing building performance in use 2: Technical performance of the Probe buildings. *Building Research & Information*, 29, 103–113. doi:10.1080/09613210010008027
- Bordass, B., Cohen, R., Standeven, M., & Leaman, A. (2001b). Assessing building performance in use 3: Energy performance of the Probe buildings. *Building Research & Information*, 29, 103–113. doi:10.1080/09613210010008036
- Bordass, B., & Leaman, A. (2005). Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques. *Building Research & Information*, 33, 347–352. doi:10.1080/09613210500162016
- BRE. (2015). Home quality mark. Retrieved from <http://www.homequalitymark.com/>.
- BRE. (2017). *What is BREEAM?* Retrieved January 20, 2017, from <http://www.breeam.com/>
- Candido, C., Kim, J., de Dear, R., & Thomas, L. (2016). BOSSA: A multidimensional post-occupancy evaluation tool. *Building Research & Information*, 44, 214–228. doi:10.1080/09613218.2015.1072298
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage.
- Chiu, L. F., Lowe, R., Raslan, R., Altamirano-Medina, H., & Wingfield, J. (2014). A socio-technical approach to post-occupancy evaluation: Interactive adaptability in domestic retrofit. *Building Research & Information*, 42, 574–590. doi:10.1080/09613218.2014.912539
- Clark, T. (2015, February 13). AJ housing survey: Post-occupancy not on architects' radar. *Architects' Journal*. Retrieved from <https://www.architectsjournal.co.uk/home/aj-housing-survey-post-occupancy-not-on-architects-radar/8678486.article>
- Cohen, R., Standeven, M., Bordass, B., & Leaman, A. (2001). Assessing building performance in use 1: The Probe process. *Building Research & Information*, 29, 85–102. doi:10.1080/09613210010008018
- Cooper, I. (2001). Post-occupancy evaluation – where are you? *Building Research & Information*, 29, 158–163. doi:10.1080/09613210010016820
- Designing Buildings Wiki. (2016a). Retrieved from https://www.designingbuildings.co.uk/wiki/Post_occupancy_evaluation_of_completed_construction_works.
- Designing Buildings Wiki. (2016b). Retrieved from https://www.designingbuildings.co.uk/wiki/Zero_carbon_homes.
- Deuble, M. P., & de Dear, R. J. (2014). Is it hot in here or is it just me? Validating the post-occupancy evaluation. *Intelligent Buildings International*, 6, 112–134. doi:10.1080/17508975.2014.883299
- Duffy, F. (2008). Forum Linking theory back to practice. *Building Research & Information*, 36, 655–658. doi:10.1080/09613210802381017
- Duffy, F., & Rabeneck, A. (2013). Professionalism and architecture in the 21st century. *Building Research & Information*, 41, 115–122. doi:10.1080/09613218.2013.724541
- Durán-Naracki, V. (2008). School building condition, school attendance, and academic achievement in New York City public schools: A mediation model. *Journal of Environmental Psychology*, 28, 278–286. doi:10.1016/j.jenvp.2008.02.008
- Dye, A., & Samuel, F. (2015). *Demystifying architectural research: Adding value to your practice*. London: RIBA Publishing.
- Egan, J. (1998). *Rethinking construction. Report of the construction task force to the Deputy Prime Minister, John Prescott, on the scope for improving the quality and efficiency of UK construction*. Retrieved from http://constructingexcellence.org.uk/wp-content/uploads/2014/10/rethinking_construction_report.pdf.
- Fairclough, J. (2002). *Rethinking construction innovation and research: A review of government R&D policies and practices*. London: Department of Trade and Industry.
- Farmer, M. (2016). Modernise or die: The Framer Review of the UK construction labour market. Retrieved from <https://www.gov.uk/government/publications/construction-labour-market-in-the-uk-farmer-review>.
- Gann, D., Salter, A., & Whyte, J. (2003). Design quality indicator as a tool for thinking. *Building Research & Information*, 31, 318–333. doi:10.1080/0961321032000107564
- Gann, D., & Whyte, J. (2003). Design quality, its measurement and management in the built environment. *Building Research & Information*, 31, 314–317. doi:10.1080/0961321032000107564
- Göçer, Ö., Hua, Y., & Göçer, K. (2015). Completing the missing link in building design process: Enhancing post-occupancy evaluation method for effective feedback for building performance. *Building and Environment*, 89, 14–27. doi:10.1016/j.buildenv.2015.02.011
- Guerra-Santin, O., & Tweed, C. A. (2015). In-use monitoring of buildings: An overview of data collection methods.

- Energy and Buildings*, 93, 189–207. doi:10.1016/j.enbuild.2015.02.042
- Gupta, R. (2014). Embedding post-occupancy evaluation into architectural education from specialism to mainstream. *AAE Conference 2014*. Retrieved from <http://architecture.brookes.ac.uk/news/resources/Embedding-POE-into-arch-education-AAE-conference-2014.pdf>
- Gupta, R., Gregg, M., Passmore, S., & Stevens, G. (2015). Intent and outcomes from the Retrofit for the Future programme: Key lessons. *Building Research & Information*, 43, 435–451. doi:10.1080/09613218.2015.1024042
- Hadjri, K., & Crozier, C. (2009). Post-occupancy evaluation: Purpose, benefits and barriers. *Facilities*, 27, 21–33. doi:10.1108/02632770910923063
- Hartman, H., & Mark, L. (2013, February 28). Look and learn. *Architects' Journal*. Retrieved from <http://www.architectsjournal.co.uk/footprint/look-and-learn/8643490.article>
- Hay, R., Bradbury, S., Martindale, K., Samuel, F., & Tait, A. (in press). *Pathways to POE*. London: RIBA.
- Henderson, J. R., Ruikar, K. D., & Dainty, A. R. (2013). The need to improve double-loop learning and design–construction feedback loops: A survey of industry practice. *Engineering, Construction and Architectural Management*, 20, 290–306. doi:10.1108/09699981311324014
- Hiromoto, J. (2015). Post occupancy evaluation survey report. Retrieved from www.som.com/FILE/22435/post-occupancy-evaluation_survey-report.pdf
- Hughes, W., & Hughes, C. (2013). Professionalism and professional institutions in times of change. *Building Research & Information*, 41, 28–38. doi:10.1080/09613218.2013.737096
- Huizenga, C. (2005). *LEED post-occupancy evaluation: Taking responsibility for the occupants*. Retrieved from https://www.cbe.berkeley.edu/research/pdf_files/Huizenga_Greenbuild2005.pdf
- Jones, S., & Grigoriou, E. (2014). *Wellbeing matters: Assessing views on the impact of the built environment on wellbeing*. London: Feeling Good Foundation.
- Kelly, G., Schmidt, R., Dainty, A., & Story, V. (2011). Improving the design process for adaptability: linking feedback and architectural values. Retrieved from http://www.arcom.ac.uk/-docs/proceedings/ar2011-0043-0052_Kelly_Schmidt_Dainty_Story.pdf
- Leaman, A., & Bordass, B. (1999). Productivity in buildings: The 'killer' variables. *Building Research & Information*, 27, 4–19. doi:10.1080/096132199369615
- Leaman, A., Stevenson, F., & Bordass, B. (2010). Building evaluation: Practice and principles. *Building Research & Information*, 38, 564–577. doi:10.1080/09613218.2010.495217
- Macmillan, S. (Ed.). (2004). *Designing better buildings: Quality and value in the built environment*. Oxon: Taylor & Francis.
- Macmillan, S. (2006). The value handbook: Getting the most from your buildings and spaces. Retrieved from <http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/publications/the-value-handbook>.
- Mallory-Hill, S., Preiser, W. F. E., & Watson, C. (Eds.). (2012). *Enhancing building performance*. Chichester: Blackwell Publishing.
- Morrell, P. (2015). *Collaboration for change: The edge commission on the future of the professionalism*. Retrieved from http://www.edgedebate.com/?page_id=2829
- Pacione, M. (1999). Applied geography: In pursuit of useful knowledge. *Applied Geography*, 19, 1–12. doi:10.1016/S0143-6228(98)00031-9
- Palmer, J., Terry, N., & Armitage, P. (2016). Building performance evaluation programme: Findings from non-domestic projects: Getting the best from buildings. Swindon: Innovate UK. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/497761/Non-Domestic_Building_performance_full_report_2016.pdf
- Planning Portal. (2008). Code for sustainable homes. Retrieved from <http://webarchive.nationalarchives.gov.uk/20151113141044/http://www.planningportal.gov.uk/buildingregulations/greenerbuildings/sustainablehomes>
- Preiser, W., & Nasar, J. (2007). Assessing building performance: Its evolution from post-occupancy evaluation. *International Journal of Architectural Research*, 2, 84–99.
- Preiser, W., & Vischer, J. (2005). *Assessing building performance*. Burlington, MA: Elsevier.
- Preiser, W. F. (2001). Feedback, feedforward and control: Post-occupancy evaluation to the rescue. *Building Research & Information*, 29, 456–459. doi:10.1080/09613210110072692
- Preiser, W. F. (2003). Continuous quality improvement through post-occupancy evaluation feedback. *Journal of Corporate Real Estate*, 5, 42–56. doi:10.1108/14630010310811993
- RIBA. (2013). RIBA Plan of work. Retrieved from <https://www.architecture.com/RIBA/Professionalsupport/RibaPlanOfWork.aspx>
- RIBA. (2014). How architects use research. Retrieved from <https://www.architecture.com/RIBA/Professionalsupport/Researchandinnovation/Assets/Files/HowArchitectsUseResearch2014.pdf>
- RIBA. (2015). Design quality and performance: Call for evidence. Retrieved from <https://www.architecture.com/Files/RIBAProfessionalServices/ResearchAndDevelopment/DesignQualityandPerformanceCall.pdf>
- RIBA. (2016). Post occupancy evaluation and building performance evaluation primer. Retrieved from <https://www.architecture.com/RIBA/Professionalsupport/Assets/Files/RIBAPOEBPEPrimer.pdf>
- RIBA. (2017). Research and innovation group. Retrieved from <https://www.architecture.com/RIBA/Professionalsupport/Professionalcommunities/ResearchandInnovationGroup.aspx>
- Riley, M., Moody, C., & Pitt, M. (2009). *A review of the evolution of post-occupancy evaluation as a viable performance measurement tool*. 4th Annual Built Environment and Natural Environment BEAN Conference. Liverpool, UK.
- Ruddock, S., & Aouad, G. (2009). Creating impact in health-care design: Assessment through design evaluation. Retrieved from: <https://www.irbnet.de/daten/iconda/CIB8993.pdf>.
- Samuel, F., Awan, N., Butterworth, C., Handler, S., & Lintonbon, J. (2014). Cultural value of architecture: A critical review with specific reference to UK homes and neighbourhoods. Retrieved from <http://www.culturalvalueofarchitecture.org/>
- SCHOSA. (2015). SCHOSA Conference 2015. Retrieved from www.schosa.org.uk/content/schosa-conference-2015

- Stake, R. (2005). Qualitative case studies. In N.K. Denzin, & Y.S. Lincoln (Eds.), *The Sage handbook of qualitative research* (pp. 19–26). London: Sage.
- Stevenson, F. (2009). Post-occupancy evaluation and sustainability: A review. *Proceedings of the Institution of Civil Engineers: Urban Design and Planning*, 162, 123–130. doi:10.1680/udap.2009.162.3.123
- Stevenson, F., & Leaman, A. (2010). Evaluating housing performance in relation to human behaviour: New challenges. *Building Research & Information*, 38, 437–441. doi:10.1080/09613218.2010.497282
- Stevenson, F., & Rijal, H. B. (2010). Developing occupancy feedback from a prototype to improve housing production. *Building Research & Information*, 38, 549–563. doi:10.1080/09613218.2010.496182
- The Fees Bureau & RIBA. (2015). *RIBA business benchmarking*. London: RIBA.
- Torrington, J. (2007). Evaluating quality of life in residential care buildings. *Building Research & Information*, 35, 514–528. doi:10.1080/09613210701318102
- Ulrich, R. S. (2008). A review of the research literature on evidence-based healthcare design. *HERD*, 1, 61–125. doi:10.1177/193758670800100306
- Vischer, J. C. (2009). Applying knowledge on building performance: From evidence to intelligence. *Intelligent Buildings International*, 1, 239–248. doi:10.3763/inbi.2009.SI02
- Watson, J., Clegg, C. W., Cowell, R., & McCarthy, N. (2015). Built for living: Understanding behaviour and the built environment through engineering and design. Retrieved from <http://www.raeng.org.uk/publications/reports/built-for-living-understanding-behaviour>
- Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Re-conceiving building design quality: A review of building users in their social context. *Indoor and Built Environment*, 25, 509–523. doi:10.1177/1420326X14557550
- Way, M., & Bordass, B. (2005). Making feedback and post-occupancy evaluation routine 2: Soft landings – involving design and building teams in improving performance. *Building Research & Information*, 33, 353–360. doi:10.1080/09613210500162008
- Wells, N. M., & Harris, J. D. (2007). Housing quality, psychological distress, and the mediating role of social withdrawal: A longitudinal study of low-income women. *Journal of Environmental Psychology*, 27, 69–78. doi:10.1016/j.jenvp.2006.11.002
- Wengraf, T. (2001). *Qualitative research interviewing*. London: Sage.
- Whyte, J., & Gann, D. M. (2001). Closing the loop between design and use: Post-occupancy evaluation. *Building Research & Information*, 29, 460–462. doi:10.1080/09613210110072683
- Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). London: Sage.