

# EFFECTIVE FEEDBACK AND SYSTEMATIC REFLECTION IN DESIGN COST ESTIMATING

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The use of an effective feedback system is considered to influence the quality of estimates. Similarly, it is held that a means of monitoring performance should be incorporated into any forecasting system. Moreover, on an individual basis, systematic reflection is considered crucial for effective experiential learning. It is suggested that only through some process of systematic reflection may a professional achieve growth and self-renewal.

This paper examines the application of effective feedback systems and systematic reflection by early stage design cost estimators. The findings from a fully structured interview survey of experienced early stage design cost estimators ( $n = 84$ ) and a questionnaire survey of student quantity surveyors ( $n = 331$ ) are presented.

Despite the recommendations of previous studies, many practitioners still have inadequate feedback systems. Many either did not systematically reflect on the outcomes of estimates, or used self-assessment as the sole means of evaluation. Also, practitioners had significantly lower Reflective Observation learning style scores when compared to the student sample, while their declared approach to learning exhibited a reluctance for self-assessment or self-appraisal. Finally, on an organisational basis both practitioners and student quantity surveyors gave a low rating to the provision of constructive feedback by the organisation on their performance.

Keywords: quantity surveyors, design cost estimating, feedback systems, systematic reflection, experiential learning.

## INTRODUCTION

Ashworth and Skitmore (1983) state that the main factor in accurately predicting construction costs is the knowledge of general price levels and that such knowledge is predominantly acquired through experience and other subjective attributes. Similarly, Oteifa and Baldwin (1991) conclude that the single most important factor in the production of any accurate estimate is an estimator's experience and expertise.

Further, Morrison and Stevens (1980) and Ogunlana (1989) have also illustrated the perceived importance of the estimator's experience within the quantity surveying profession. Experience is, therefore, considered by far the most important factor affecting the performance of early stage design cost estimators. It is believed to be acquired over time and has been associated with the development of knowledge, familiarity, feedback, professional judgement and estimating expertise.

This paper examines the application of effective feedback systems and systematic reflection by early stage design cost estimators.

## LEARNING FROM EXPERIENCE

Further research into the influence of experience on estimating performance has been suggested in order to improve the selection, manipulation and application of costs (Morrison and Stevens 1980) and into improving learning from experience (Ogunlana 1989). Ogunlana (1989) states “the development of individual expertise in cost estimating seems a viable option for improving estimating performance. Research into the qualities in the individual that tend to make them better estimators is necessary to determine how such qualities can be recognised in people, how they can be developed and what method of training will best enhance these qualities in individuals”.

Ogunlana (1989) found that design estimators are not learning adequately from experience, that there is an illusion of validity and that failure to learn originates from the lack of a system for monitoring estimating performance. He recommended the incorporation of feedback techniques as representing a potential force for improving accuracy. In the short term, Ogunlana (1991) suggests that design offices will be required to set up formal systems for self-evaluation that promotes learning through constructive use of process and outcome feedback.

### **The feedback system**

The use of an effective feedback system is considered to influence the quality of estimates (Skitmore *et al.* 1990) by providing information on the accuracy of previous forecasts (Flanagan and Norman 1983) and by providing more accurate rates for current estimates (Skitmore 1990). Similarly, Morrison (1984) suggested that “... the achievement of an increase in accuracy is dependent upon the means by which knowledge and experience gained on previous projects is related to future work. In those offices where an improved performance was detected, it was noticeable that either a central library of information or an index system by which the quantity surveyors could familiarise themselves with the data at their disposal had been constructed”.

Raftery (1991), when considering what should be included in a simple forecasting system, highlights, amongst others, a method of allowing human judgement where personnel are held accountable for any interventions they make and a means of monitoring the performance of the forecasting system. In order to increase the awareness of bias within estimating, Raftery (1994) suggests the introduction of procedures that incorporate feedback loops into the filing of estimates and forecasts, the fostering of a culture of estimating and forecasting, which centres on explicitly dealing with risk and uncertainties, and that accepts that some forecasts will prove to be inadequate. Procter *et al.* (1993), also, recommend the introduction of feedback mechanisms to establish the levels of satisfaction with ‘pro-active interaction’ between the providers and users of the price advice to ensure that maximum benefit is obtained by the latter.

Skitmore (1985) states that “... the foundation of knowledge and experience has been repeatedly confirmed by reference to knowledge of the database and experience of similar work reinforced by feedback from a sufficient amount of projects”. The application of experiential factors seems to be enhanced where suitable feedback systems are in operation. Investigations have, however, revealed that few early stage design cost estimators objectively measure their estimating performance (Beeston 1983). Flanagan and Norman (1983) recommend that “... there is a need for

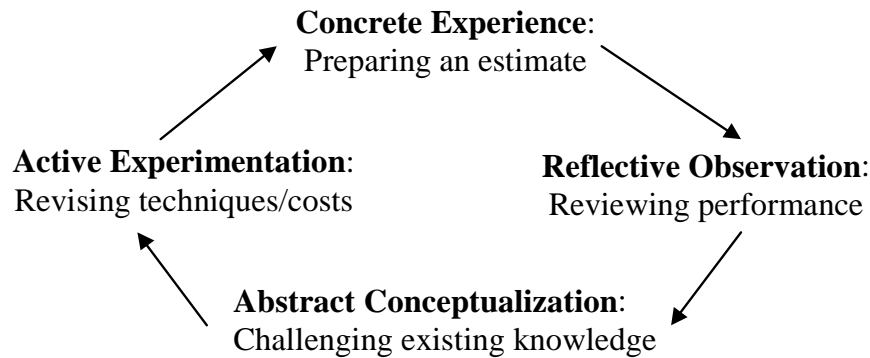


Figure 1: Kolb's (1984) experiential learning cycle applied to the estimating process

estimating performance to be monitored consistently. The custom in the building industry appears often to have been to take the forecast, as being 'correct' and the tenders, when they differ from the forecast, as being 'wrong'".

### **Experiential learning**

Eraut (1994) concludes that learning from experience is extremely important in professional development, and requires an ability to conceptualise and an ability to evaluate. Further, it is important for professionals to sustain a critical and evaluative attitude towards practice, so that they seek to improve it and do not lapse into complacency.

Kolb (1984) proposes a model of experiential learning, which comprises the cycle of concrete experience, observation and reflection, formulation of abstract concepts and generalisations and testing implications of concepts in new situations (See Figure 1). He defines learning as "the process whereby knowledge is created through the transformation of experience" and occurs "through the active extension and grounding of ideas and experience in the external world and through internal reflection about the attributes of these experiences and ideas". Further, Boreham (1987) comments that the term 'learning from experience' really means learning from reflection on experience.

### **Reflection**

Boud *et al.* (1985) define reflection as a form of response of the learner to experiences, "... a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations".

Reflection both in terms of a form of deliberation and metacognition are important contributors to professional expertise, however, most expert performance is on going and non-reflective (Eraut 1994). According to Schön (1987) "... the only way that a professional person may achieve growth and self-renewal is through some process of systematic reflection". Most models of experiential learning assume that reflection will happen, but the application of reflection will depend on the disposition of the learner (Eraut 1994). "The capacity to reflect is developed to different stages in different people and it may be this ability which characterises those who learn effectively from experience" (Boud *et al.* 1985). According to Duley (1981), however, "the skill of experiential learning in which people tend to be most deficient is reflection". Also, the professional's environment will probably include barriers to the effective reception of feedback (Boreham 1987). "Deliberation is unlikely to

occur in the workplace unless the professional(s) concerned build deliberate time into their performance periods” (Eraut 1994).

Eraut (1994) comments that “... self-knowledge of performance is difficult to acquire, and self-comment tends to be justificatory rather than critical in intent”. Similarly, Schön believes that “many practitioners, locked into a view of themselves as technical experts, find nothing in the world of practice to occasion reflection... for them, uncertainty is a threat; its admission is a sign of weakness” (Schön 1983). Likewise, people have a tendency to seek information to confirm their ideas rather than to look for possible disconfirming evidence and positive feedback is weighed more heavily in memory than negative feedback (Hogarth 1987).

Gibbs (1988) suggests that log books, diaries, video and audio recordings, peer appraisal, structured discussions, structured debriefing, self-assessment, reflection check-lists and questionnaires are helpful in assisting learners to reflect on their experiences. Further ways of enhancing reflection include portfolios, journals and collaboration.

Feldman (1986) considers that “the environment strongly influences the degree to which useful feedback is available”. Mumford (1986) presents an organisational culture climate approach, in which an organisation encourages learning if: it encourages managers to identify their own learning needs and sets challenging learning goals; it encourages managers to experiment; it provides opportunities for learning both on and off the job; it gives on-the-spot feedback; it allows time for managers to review, conclude and plan learning activities, and it tolerates some mistakes, provided managers try to learn from them.

## **METHODOLOGY**

The data collection was divided into two distinct parts: one representing experienced practitioners and the other representing the novice quantity surveyor.

### **Practitioners**

This stage of the investigation adopted a fully structured (face to face) interview survey, which, in part, required the interviewees to complete a multi-sectional questionnaire. The questionnaire comprised: an experience profile, provided information concerning the position of the subject within their organisation, their estimating experience, performance and practice; a revised randomised version of Kolb’s (1985) Learning Style Inventory (LSI - 1985); an approaches to learning questionnaire (ALQ), which required the subjects to rate the strength of their agreement to twenty-four statements on a five-point agreement scale; and the learning climate questionnaire (LCQ), which required the subjects to rate fifteen pairs of statements on a five-point semantic differential scale. The population for the investigation was experienced quantity surveyors (involved in early stage design cost estimating) based within Greater Manchester, Central Lancashire and South Lakeland. The area of study was selected as representative of North West England. Ultimately, 84 practitioners from 77 practices took part. This represents 45% of the target organisations.

### **Student quantity surveyors**

This stage of the investigation used two separate questionnaires depending on the mode of study (part-time or full-time) of the students. Questionnaire one administered to part-time students contained the revised version of Kolb’s LSI - 1985, the LCQ and

details of the student's year of study and category of employment. Questionnaire two administered to full-time students contained the revised LSI - 1985, the ALQ and details of the student's year of study. The questionnaires were administered to students enrolled on built environment courses at five institutions of higher education located within the North West. The sample comprised 63 students (19%) on full-time subdegree programmes, 131 students (39.6%) on full-time BSc degree programmes and 137 students (29.5%) on a part-time BSc degree programmes in Quantity Surveying. The sample was taken to represent the novice quantity surveyor.

## RESULTS

### Feedback systems

The responses revealed that 70 respondents (83.3% of the sample) had estimating procedures that positively encourage systematic reflection on the outcomes of estimates, while 14 (16.7%) had no such procedures. Those that stated they had estimating procedures that positively encourage systematic reflection on the outcomes of estimates responded as follows:

The most popular response was self assessment with 32 practitioners (45.7%) indicating using it as their sole means of evaluation, the second most popular method was a combination of peer and self assessment with 14 respondents (20%) using this combination, nine surveyors (12.9%) indicated the use of a combination of self assessment with some other method other than peer appraisal while five surveyors (7.1%) indicated the use of a combination of peer and self assessment with a further method. The sole use of peer appraisal was indicated by five interviewees (7.1%), while two surveyors used a combination of peer appraisal and a further method. It is interesting that only two interviewees use diaries and these were in association with either peer or self-assessment. Also, only two respondents indicated the use of logbooks, again these were used in combination with self-assessment. Finally interviewees also indicated the use of formal and informal cost analysis, compiling databases - either individually or as an organisation, quality management systems and discussion/review with colleagues.

If the practitioners had indicated they had no procedures that positively encouraged systematic reflection on the outcomes of estimates, they were asked how they did reflect on their estimating performance, if at all. Responses revealed: "performance review on a job by job basis, i.e. only when tenders are high", "time constraints rarely allow time for reflection etc.", "client judgement and satisfaction", "use as a guide for next time", "mental comparison with tenders", "close to lowest tender" and one interviewee made no comment.

When asked what would or does prompt them to review their estimating practice, 87% of the practitioners suggested a desire to continually improve, 70% client and self dissatisfaction, and 67% new opportunities. The results would suggest that the quantity surveyors consider themselves proactive besides reactive. Pressure of work, feeling harassed and short of time were suggested as the main barriers to changing or questioning estimating performance. This finding is in accord with Houle (1980) who states that the major self-perceived barrier to learning for professionals is insufficient time. Overall, however, 62% of the sample considered that they were unlikely to change or experiment with the way they prepared estimates within the next twelve months.

### Individual Learning Styles

The order of preference of the LSI - 1985 learning style sub-scales for the student sample and practitioner samples were Active Experimentation (AE), Abstract Conceptualisation (AC), Reflective Observation (RO) and Concrete Experience (CE) based on the descending order of mean sub-scale scores. The means and standard deviations for the LSI sub-scales are presented in Table 1.

**Table 1:** Means, standard deviations and tests for differences for Kolb's Learning Style Inventory – 1985 revised sub-scale scores

Sample	N		CE <sup>1</sup>	RO	AC	AE <sup>1</sup>	AC-CE <sup>1</sup>	AE-RO <sup>1</sup>
Practitioners	84	Mean	32.43	32.86	36.82	40.49	4.39	7.63
		SD	4.61	6.57	4.85	4.40	5.21	6.85
Students	326	Mean	30.92	34.33	35.51	39.97	4.59	5.64
		SD	5.20	5.79	5.53	5.23	6.13	7.16
Practitioners/ Students	84 326	't' <sub>1</sub>	2.42*	-2.02*	1.99*	0.84	-0.27	2.29*
		't' <sub>2</sub>	-2.13*	-1.91	-1.80*	-0.53	-0.46	-2.35*

NB: <sup>1</sup> = Lilliefors (Kolmogrow-Smirnov) test of normality indicates that a non-parametric test is appropriate; \* =  $p \leq 0.05$ ; 't'<sub>1</sub> = t-test for Independent Samples, 't'<sub>2</sub> = Mann-Whitney U – Wilcoxon Rank Sum W Test.

Tests for differences indicated that the practitioners prefer an active and analytical learning style, represented by Active Experimentation and Abstract Conceptualisation rather than a reflective style, represented by learning by Reflective Observation. For Concrete Experience and Abstract Conceptualisation the scores for the practitioners were significantly higher than those of the students, while the Reflective Observation scores for the practitioners were significantly lower than those of the students.

### Approaches to Learning

There was general agreement between the student and practitioner samples in the rank order of the approaches to learning items based upon the mode. The results indicated a preference for an open and collaborative approach to learning, represented by a high rating of: "I can accept help from others"; "I am open to new angles and possibilities"; and "I make a conscious effort to learn from experience". They also suggested a reluctance for self-assessment or self-appraisal, represented by the relatively low rating of: "I regularly assess my own development needs", "I often take time to review my performance"; and "I ask for feedback on my performance" ranked 18<sup>th</sup>, 19<sup>th</sup> and 24<sup>th</sup> out of 24 respectively by the practitioners and 18<sup>th</sup>, 20 and 24<sup>th</sup> by the students (Table 2). Further, the Wilcoxon signed ranks test between the practitioners responses to these questions and the mode/median response revealed that all were significantly lower than the mode/median response (all significant at the 0.1% level). The Mann-Whitney U/Wilcoxon W test revealed no significant difference between the responses by the practitioners (n = 84) and part-time students (n = 194) for the items "I ask for feedback on my performance" and "I regularly assess my own development needs". However, for the statement "I often take time to review my performance" the practitioners' score was significantly higher than that of the students (significant at the 5% level). The low rating of self-assessment may be linked to individuals acquiring a vested interest in not noticing their inadequacies. Heron (1985) refers to this as falsification, while Eraut (1994) comments that "... self-knowledge of performance is difficult to acquire, and self-comment tends to be justificatory rather than critical in intent".

**Table 2:** Ranking of individual items of approaches to learning questionnaire based on mode (n = 84)

Rank	Item	Disagree			Agree			Median	Z Score
		0	1	2	3	4			
18	1	I often take time to review my performance	2	8	30	<b>31</b>	13	3	-4.205***
19	13	I regularly assess my own development needs	3	11	<b>39</b>	22	19	2	-5.633***
24	17	I ask for feedback on my performance	5	14	<b>26</b>	24	15	2	-4.596***

NB: Mode = bold; \*\*\* =  $p \leq 0.001$ ; Z Score = Mann-Whitney U – Wilcoxon Rank Sum W Test between practitioner/student responses

The practitioner's responses to items 1, 13 and 17 were tested for differences between sub-groups based on their method of reflecting on the outcomes of estimates. Group one were those who used peer appraisal and combinations of methods (n = 36); group two, those who used self-assessment and other single responses (n = 34) and group three, those who had indicated they did not systematically reflect on the outcomes of estimates (n = 14). The Kurskal-Wallis one-way Anova test revealed no significant differences in responses for the items "I regularly assess my own development needs" and "I often take time to review my performance". It did, however, reveal a significant difference in the responses to the statement "I ask for feedback on my performance" (significant at the 5% level). Further investigation revealed that the responses for groups one and two were both significantly higher than for group three - those who had indicated they did not systematically reflect on the outcomes of estimates.

As previously stated, systematic reflection is considered crucial for effective experiential learning, for example, Eraut (1994) considers to be an important contributor to professional expertise. The results are, however, in keeping Casey (1983) who suggests that the regular opportunity to pause and reflect before having another go is not necessarily present in a manager's working life and Eraut (1994) who states that most expert performance is on-going and non-reflective.

### The Learning Climate

The individual statements of the LCQ were ranked based on the mode response. The results suggest that the working environment was less than supportive in the provision of constructive feedback on performance and the identification of development needs. The statements "Constructive feedback is often provided about your performance" and "There is a systematic process for identifying individual development needs" were ranked 13<sup>th</sup> and 15<sup>th</sup> out of 15 items respectively by the practitioners (Table 3) and ranked 13<sup>th</sup> and 14<sup>th</sup> by the students. Further, the Wilcoxon signed ranks test between the practitioners responses to these statements and the mode/median response revealed that both were significantly lower than the mode/median response (significant at the 0.1% level). The Mann-Whitney U/Wilcoxon W test revealed that the practitioners' score was significantly higher than that of the students for both "Constructive feedback is often provided about your performance" and "There is a systematic process for identifying individual development needs" (significant at the 0.1% and 5% level respectively).

**Table 3:** Ranking of individual statements of learning climate questionnaire based on mode

(n = 84)

Rank	Item	0	1	2	3	4	Median	Z score
13	<b>Q9</b> Constructive feedback is rarely provided about your performance	2	15	<b>33</b>	27	7	2	-5.617***
15	<b>Q3</b> The identification of development needs is left to the individual	7	<b>26</b>	24	20	7	2	-6.354***

NB: Bold = Mode; \*\*\* =  $p \leq 0.001$ ; Z Score = Mann-Whitney U – Wilcoxon Rank Sum W Test between practitioner/student response

Despite the recommendations of Flanagan and Norman (1983), Morrison (1984) and Ogunlana (1989), that design offices should introduce formal feedback systems, it would appear from the low ratings given to a systematic process for identifying individual development needs within organisations and to the provision of constructive feedback that many surveying organisations still have to implement this suggestion. This may be systematic of the lack of self-reflection and self-assessment within the individual. The statement “Constructive feedback is often provided about your performance” correlates significantly and positively with “I ask for feedback on my performance” (Spearman’s rho = 0.334, significant at the 0.02% level) and “I regularly assess my own development needs” (Spearman’s rho = 0.306, significant at the 0.05% level).

## CONCLUSIONS

Systematic reflection is considered crucial for effective experiential learning, for example, Schön (1987) suggests that it is only through some process of systematic reflection that a professional may achieve growth and self-renewal. On an individual basis, however, many practitioners either did not systematically reflect on the outcomes of estimates, or used self-assessment as the sole means of evaluation. Moreover, only four practitioners used diaries or logbooks to aid reflection despite them being considered helpful in aiding reflection on experiences (Gibbs 1988). Also, the practitioners had significantly lower Reflective Observation learning style scores when compared to the student sample, while their declared approach to learning exhibited a reluctance for self-assessment or self-appraisal. On an organisational basis both practitioners and part-time students gave a low rating to the provision of constructive feedback by the organisation on their performance. The results, however, are in keeping with Beeston (1983) who maintained that few practitioners objectively measure their estimating accuracy, Ogunlana (1989) who found an absence of a system requiring regular monitoring of estimating performance and Duley (1981) who considers reflection to be the skill that most people lack. The results lead to the conclusion that, despite the recommendations of Flanagan and Norman (1983), Morrison (1984), and Ogunlana (1989), many practitioners still have inadequate feedback systems on their estimating performance. It is suggested that surveying organisations should introduce effective feedback mechanisms that require both the individual to critically reflect on their estimating performance and the organisation to provide effective constructive feedback on an individual’s estimating performance.



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