Experiential learning a factor in cost estimating

Citation for published version (APA):

Published in:
Proceedings of the Ninth Annual ARCOM Conference

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Experiential Learning: The Development of an Expert Pre-tender Estimator

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This paper examines the preferred learning styles of novice quantity surveyors and "expert" pre-tender cost estimators since the experience of the estimator is held to be a factor in the accuracy of quantity surveyors' cost estimating. It reveals that the novice quantity surveyors underutilize the doing (concrete experience) and accentuates the reflective (reflective observation) stages of the experiential learning cycle. The "expert" pre-tender estimators underutilize the reflective (reflective observation) and have a tendency towards the planning (active experimentation) and doing (concrete experience) stages. It concludes that the encouragement of pre-tender estimators to reflect on their actions together with the introduction of a feedback mechanism that incorporates self monitoring/assessment could lead to an improvement in the consistency and accuracy of pre-tender estimates.

Keywords: Cost estimating, cost planning, accuracy, quantity surveyor, expert, experience, experiential learning

Introduction

The forecasting of likely costs within the construction industry is, as Brandon (1990) states, "... probably the most fundamental professional service provided by quantity surveyors". (p 12-13) Despite this, initial cost advice given before the production of drawn information has been a source of client dissatisfaction. (RICS 1984) Over the last decade there has been a considerable amount of research into the accuracy of cost prediction, cost planning techniques and more recently the application of expert systems for project appraisal. One factor that consistently appears throughout this research is the perceived importance of the experience of the pre-tender estimator. While previous researchers have acknowledged that the experience of the estimator is a significant factor, this has primarily been viewed in terms of the number of years the individual has been an estimator and the number and types of projects undertaken (Skitmore 1985, Skitmore et al 1990). Nevertheless Trench (1983) suggests "... you do not have to be old to have had experience of lasting value to both yourself and the organisation in which you work... but the use of that knowledge is limited if it is not effectively recorded and communicated to others". (p 2) It is not, therefore, the time span that is significant but the successful incorporation of the experience into working practices and an individuals knowledge base.

The majority of current research has been into the improvement of cost forecasting with the introduction of new techniques, primarily computer based. An analysis of how expert
pre-tender estimators have developed through learning from experience and an assessment of why others fail to learn from experience needs to be made in order to facilitate an improvement in early stage cost forecasting. This paper investigates the importance of experiential learning as a contributory factor in the development of a quantity surveyor's estimating ability from the status of a "novice" to an "expert".

Experience

The underlying assumption of this paper is that experience is a major factor in the development of the novice quantity surveyor to the status of an "expert" pre-tender estimator. The majority of researchers into accuracy of cost prediction support the premise that the personal experience of the pre-tender cost estimator is a major factor in estimating accuracy. References have been made to the estimators "background of experience" (Park 1966), "familiarity with a building type or client" (Morrison and Stevens, 1980, Willis and Ashworth, 1987 and Flanagan and Stevens 1990) and "knowledge acquired through experience" (Ashworth and Skitmore, 1983) While the following experiential factors are considered to be significant; experience areas geographically, technically and of the related industry; knowledge of buildings and familiarity with projects; personal or individual experience; professional expertise and judgement and the individual estimator. It is, therefore, the insight and development derived from the experience by the pre-tender estimator that requires further investigation.

Experience has been defined as the "actual observation of, or practical acquaintance with facts or events, practise in doing something or knowledge or skill gained from this experience (noun) or meet with, feel, find by, undergo or suffer (transitive verb)". (Oxford Dictionary 1981) There are, therefore, two aspects to experience, the actual participation in an "activity" and the knowledge or learning derived from it. While a Novice has been defined as " a person who is inexperienced in the work etc. that he or she is doing, a beginner". (Oxford Paperback Dictionary, 1988) Stockley (1987) has defined an Expert as"... someone who has a deep and proven knowledge in a particular domain where the knowledge represents the expert's range of information about or familiarity with the domain gained by experience... and it ... is this ability to use his practical experience gained in the "real world" to offer a solution which is not only correct but "workable" which gives the consulting of a specialist value". (Stockley, 1987 p 480) She defines expertise as "primarily a skill of recognition, of "seeing" old patterns in a new problem". (Brown and Stockley, 1990 p 174) The transition from the position of novice to an expert in pre-tender estimating could be said, therefore, to be derived from accumulated experience within the field of cost prediction.

How do "expert" pre-tender estimators learn from experience?

The surveys by Grieg (1981), Morrison and Stevens (1980), Skitmore (1985), Ogunlana (1989) and Skitmore et al (1990) have all illustrated the perceived importance of the estimator's experience within the quantity surveying profession. Skitmore et al (1990) concluded that there was a " tendency has been noted for the expert estimator to
specialise in estimating with the passage of time. The highest levels of presumed expertise has been shown by estimators in the experience range thirty five to forty four years. These observations lead to the conclusion that acquisition of expertise is thought to be an ongoing process..." As the acquisition of expertise is considered to be an ongoing process it can be deduced that the "expert" pre-tender estimator learns from experience (i.e. "by doing"). Stockley (1987) states "It is this ability to use his practical experience gained in the "real world" to offer a solution which is not only correct but "workable" which gives the consulting of a specialist value" (p 480). It appears, however, that estimators are failing to adequately learn from their experiences. An investigation is, therefore, required to investigate how "expert" estimators learn from their experiences. (Ogunlana 1989,1991)

**Developmental Factor**

The consideration of experience as a developmental factor in expertise has, to date, centred on the length of time an estimator has been practicing and the types of buildings/projects an estimator has had experience of. Experience, however, as already stated, encompasses not only these aspects, but also the reactions of the estimator to the experience. It has been suggested that fifteen years experience could merely equate to 15 x 1 years experience. This statement can be supported by Skitmore et al's (1990) analysis of the effects of the number of projects and the length of experience of an estimator. "Experience length too has failed to prove itself an "all important" factor in that the above ordering shows that long experience is not necessarily associated with good estimating... neither experience length nor number of projects should be looked at in isolation. They should be considered in the light of other factors which may or may not be equally important". (p 61) It is, however, the insight and development derived from the experience by the "expert" pre-tender estimator that requires further investigation.

**The use of effective feedback systems**

The use of effective feedback systems is considered to improve the accuracy of pre-tender estimates. Likewise experts, it is suggested, possess strong self-monitoring skills. Flanagan and Norman (1983) Morrison (1984) and Skitmore and Tan (1988) have all made reference to the use of feedback systems. The application of experiential factors would seem to be enhanced where suitable feedback systems are in operation. This appears to be supported by the findings of Ogunlana (1989 and 1991) who suggests that estimators are not learning sufficiently from experience. Historical cost data is not used to the optimum effect for improving performance and the failure to learn is derived from the absence of a system for monitoring estimating performance in design offices. He considers feedback techniques to represent a potential force in improving accuracy and in developing individual expertise. Both Morrison and Stevens (1980) and Ogunlana (1989) suggest further research, (Morrison and Stevens) into estimating experience in order to improve the selection, manipulation and application of costs and (Ogunlana) into improving learning from experience. 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.

Who are "expert" pre-tender estimators?

As there is confusion over who "true" expert estimators are, could they be considered to be someone who is prepared to question what they are doing, reflect on their experience, integrate these new assumptions into their existing concepts and then be prepared to experiment when faced with a similar situation in the future? This process could be described as an ability to change ones perspective when faced with a problem. Since Handy (1990) equates change with learning some insight into the expert may be gained by researching into the theories of experiential learning.

Learning Theory

Learning is, to quote Wilson (1980), "... a cognitive activity that involves the use of intellect for the development and structuring of understanding about oneself and the world in which one lives. Learning is a continuous process of organising and reorganising what is known and believed to be true on the basis of new evidence. This process occurs within the individual, and during this process numerous personal and emotional attributes interact. Additionally, theorists agree that learning culminates in change". (p 70) While Kolb (1984) defines learning as "the process whereby knowledge is created through the transformation of experience" (p 38) 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" (p 52).

Experiential Learning

A review of learning theories revealed that several educationalists consider experiential learning to be the most significant aspect in personal development. According to Kemmis (1977), learning cannot be considered independently of experience, while Boydell (1976), equates professional competence to the ability to learn from experience. Chickering (1976) defines experiential learning as "the learning that occurs when changes in judgements, feelings, knowledge, or skills result for a particular person from living through an event or events". (p 63) Whereas, Boydell (1976) considers experiential learning to be synonymous with "meaningful discovery".

Several models of the experiential learning cycle have been produced, the majority comprising four mutually important stages. Table 1 illustrates the names given to these stages.

Table 1 Stages of the experiential learning cycle

<table>
<thead>
<tr>
<th>Source</th>
<th>Doing</th>
<th>Reflecting</th>
<th>Thinking</th>
<th>Planning</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>
Experiential Learning: The Development of an Expert Pre-tender Estimator

Dewey 1930's 
Impluse Observation Knowledge Judgement

Kolb 1971 Concrete Experience Reflective Observation Abstract Conceptualisation Active Experiementation

Boydell 1976 Problem Situation Perceptions from Situation Sorting things out Making sense Action Plans

Juch 1981 Doing Sensing Thinking Addressing

Honey and Mumford 1989 Having an Experience Reviewing the Experience Concluding from the Experience Planning the next Experience

Dennison and Kirk 1990 Do Review Learn Apply

Gibbs 1990 Experience Reflection Conceptualisation Experiementation

Handy 1990 Test Reflection Question Theory

Gibbs (1988) describes the process as follows:

1. "Learners are involved in an active exploration of experience. Experience is used to test out ideas and assumptions rather than to obtain practise passively. Practice can be very important but it is greatly enhanced by reflection.

2. Learners must selectively reflect on their experiences in a critical way, rather than take experience for granted and assume that the experience on its own is sufficient.

3. The experience must matter to the learner. Learners must be committed to the process of exploring and learning.

4. Openness to experience is necessary for learners to have the evidence upon which to reflect. It is therefore crucial to establish an appropriate emotional tone for the learner: one which is safe and supportive, and which encourages the learners to value their own experience...". (p 14-15)

Reflection

Most experiential learning theories adopt a cyclic model with four distinct and mutually important stages. As Honey and Mumford (1989) suggest "knowing about different learning style preferences is the key to understanding and to becoming more effective at learning from experience". However, one of the key processes in learning from experience Boud, Keogh and Walker (1985) suggest is reflection which they define as as "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". (p 19) The importance of the reflective stage of the learning cycle is supported by Maclean (1987) who states the crucial element "in the use of an experiential approach is reflection. Reflection implies a conscious consideration of experience and ideas and can serve as a
naming or labelling activity... The process involves more than recollection". (p 131-132) This is echoed by Gibbs (1988) who considers that "... it is not sufficient simply to have an experience in order to learn. Without reflecting upon this experience it may quickly be forgotten or its learning potential lost. Reflection should lead to a change i.e. modification (Pedler et al., 1986) or reframing. (Boxer, 1985 and Handy 1990) While all four elements of the cycle are necessary for progression it is often the area of reflection, for the busy practitioner, that becomes neglected. Due to pressure of work tasks are performed in the "traditional" or "normal" manner resulting in little or no reflective thought and, therefore, no experimentation.

It is this area of reflection where the expert estimator may possess different abilities. Handy considers that "success without prior thought or subsequent reflection does not help you to repeat the process or improve on it". However, "most of the time, most of us do not go through all the four segments of this wheel. (Handy, 1990 p 49-50) This assumption is supported by Boud (1987) who asserts that "learning in which adults engage requires considerable effort on the part of the learners, not just in receiving new ideas but in assimilating them, adjusting their behaviour in the light of them and taking action of many different kinds". (p 233) This supposition is further supported by the research of Garratt (1987) who's experience with directors has shown that "... they shy away from the reflection quadrant... their most common model of learning seemed to be action, observation, hypothesis.

Openness to experience

It has been suggested that experiential learning is considered by most people to be an unconscious and accidental process (Honey and Mumford, 1989a p 1-2). However, an individuals openness to experience is held to be a significant factor in learning from experience. (Gibbs 1988). Research has revealed that adults tend to be less openminded (Knowles (1970), people who are not experienced in open appraisal are entrenched in their professional view (Juch 1981) and specialisation can lead to a parochial narrowness of view (Schon 1983). According to Pedler et al. (1986) "if the learner is open and willing to learn, examination of these experiences will provide clues as to how existing behaviour can be modified... Unexamined happenings in life are not experiences - merely things which happened and passed without impact." (p 225) Boud and Walker (1990) believe that a "greater awareness of what is happening in, and a more deliberate interaction with, the learning milieu will provide greater opportunities for a more fruitful learning experience... There is potential for learning in every situation and it is up to the learner to realise this potential. It is the learner's interaction with the learning milieu which creates the learning experience". (p 62)

Ways of enhancing experiential learning

Reflection

The following are considered to aid the reflective stage of the learning cycle:
Experiential Learning: The Development of an Expert Pre-tender Estimator

1. Portfolios - a record of the significant learning experiences. (Walker, 1985 p 54)
2. Journals - the collection of provoked and recorded self-reflection to promote the attitude of self-reflection. (Kemmis, 1985 p 160) or Daries (Gibbs, 1988 p40)
3. Sounding board - talking about one's ideas, thoughts and reflections. (Walker, 1985 p 56; Harri-Augstein and Thomas, 1985 p 102)
4. Debriefing - an opportunity for structured reflection. (Pearson and Smith, 1985 p 70) or peer appraisal (Gibbs, 1988 p40)
5. Collaboration - allows individuals to examine and analyse their own uncertainties and dissatisfactions with others. (Kemmis, 1985 p 153)
6. Behavioural record - a videotape, an observation sheet or a computer analysis of the learning situation. (Harri-Augstein and Thomas, 1985 p 115) or video or audio recording (Gibbs, 1988 p40)
7. Reflective analysis - the production of lists of past experiences and present options. (Boxer, 1985 p 119) or self assessment, reflection check list and questionnaires (Gibbs, 1988 p40)
8. Convergent thinking - reflecting on divergent aspects and perspectives, refining each and bringing out the common ground they illuminate. (Heron, 1985 p 137)

Planning

Gibbs (1988) suggests that action plans, setting objectives, designing experiments, observation check-lists, devising criteria, learning contracts and action research will enhance the planning stage of the learning cycle. (Gibbs, 1988 p 24, Habeshaw).

Doing

The following are held to increase awareness during the experience - log books, listening exercises, questions, increasing awareness of feelings and silent demonstrations. (Gibbs, 1988 p24, Habeshaw)

"Ideal" learners

These factors are incorporated in the definition of the ideal learner provided by Honey and Mumford (1989a) who "often review their experiences; can describe the steps they go through to learn from experience; openly share their experiences; respond flexibly to the unexpected; reach conclusions via careful thought; have detailed recall; can bridge the gap between artificial situations and reality; put deliberate effort into learning; ask questions; listen patiently; express thoughts fluently; are open to new angles, possibilities; identify their own development needs; can convert ideas into feasible actions; take risks; see connections; ask for feedback; adjust quickly to new, unfamiliar situations; make specific action plans; convert criticism into constructive suggestions for improvement". (Honey and Mumford, 1989a p 5)

Problems in learning from experience
Heron (1985) suggests that people acquire a vested interest in not noticing the inadequacies in the face of experience which he terms falsification. (p 134) This theme is echoed by Sutton (1983). "Too often experience is the barrier to learning and new learning ventures take the form of attempts to escape from the constraints of old experiences and old habits derived from those experiences". (p 72). As, however, Casey has pointed out "one condition for learning which is not necessarily present in a manager's working life... is the regular opportunity to pause and reflect before having another go". (Casey, 1983a p 43) Juch is of the opinion that few people, without help, are able to realise how and when they learn and which cues trigger off their spontaneous and intuitive thoughts and behaviour.

However, relatively little thought seems to have been given to the way in which we learn from our everyday experiences, or to developing methods of helping us to learn more effectively. Boydell (1976) has acknowledged that "A great deal of weight is often given to experience... but in practice experience becomes synonymous with "age" or "length of service". This is confirmed in chapter 2 by the responses to Skitmore's (1985 and 1990) surveys. The investigation of how experts react to their experiences is supported by Feldman (1986) who states "the conditions under which experts are more or less likely than novices to learn effectively need further investigation". Lawlor (1983) suggests the clue is feedback from the results of our own actions which is supported by Feldman and Goldberg. (p 201)

Professional Competence

O'Houle (1980) has made the link between experiential learning and continuing learning in the professions stating "in most continuing professional education, the learning that results from experience is its own reward". (p 222) Likewise Jarvis (1983) suggests that "lifelong learning is fundamental to professionalism" and Lovell (1983) discusses the significance of self-directed learning for the professional practitioner. Schon (1987) states "in a busy life of continuous demands and increasing accountability the only way that a professional person may achieve growth and self-renewal is through some process of systematic reflection." Juch equates professional competence to his cyclic learning stages. "We only speak of a person as professionally competent if he is an educated observer, and understands what he is doing, and is able to plan and organise applications, and is experienced in their execution". ( 1981 p 162)

The novice quantity surveyor's preferred learning style

In order to analyse the development of the "expert" pre-tender estimator through experiential learning a comparison is necessary of the learning styles of the "expert" with those of the novice quantity surveyor. Kolb's (1979, 1984) Learning Style Inventory was used to establish the preferred learning styles of 42 students on a BTEC/College Diploma in Quantity Surveying and two samples of part-time undergraduate quantity surveying students, containing 120 and 41 students respectively. This required the students to grade nine sets of four words, on a scale of 1 to 4. The score of 4 represented the word that best characterised their learning style, while the score of 1 least represented their preferred
Experiential Learning: The Development of an Expert Pre-tender Estimator

learning style. Once the inventory had been completed the students were required to compute the gradings obtained. This involved the summation of six scores for those words which represented the learning styles of Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation. Once these scores had been computed the students plotted the scores on the Personal Learning Profile which graphically represents the preferred learning style. The students were required to compute two combined scores by subtracting the sum of Concrete Experience from Abstract Conceptualization and Reflective Observation from Active Experimentation. The resultant figures were used as co-ordinates and plotted on the "Learning Style Type Grid". This establishes, according to Kolb, whether the students are Accomodators, Divergers, Assimilators or Convergers (Kolb 1979, 1984). To establish the learning preferences for the "average" novice quantity surveyor the three samples were combined. The distribution of the preferred learning styles is tabulated as follows:

Table 2 Distribution of learning styles (Kolb) based on the total sample.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Assimilator</th>
<th>Converger</th>
<th>Diverger</th>
<th>Accomodator</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/T Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.9,3)</td>
<td>8 (19%)</td>
<td>11.5 (27%)</td>
<td>15 (36%)</td>
<td>7.5 (18%)</td>
</tr>
<tr>
<td>(2.9,4.5)</td>
<td>5 (12%)</td>
<td>9 (21%)</td>
<td>18 (43%)</td>
<td>10 (24%)</td>
</tr>
<tr>
<td>P/T Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 120</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.9,3)</td>
<td>27 (23%)</td>
<td>32 (27%)</td>
<td>32 (27%)</td>
<td>29 (24%)</td>
</tr>
<tr>
<td>(2.9,4.5)</td>
<td>20 (17%)</td>
<td>23 (19%)</td>
<td>39 (33%)</td>
<td>38 (32%)</td>
</tr>
<tr>
<td>P/T Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.9,3)</td>
<td>10.5 (26%)</td>
<td>9.5 (23%)</td>
<td>16.5 (40%)</td>
<td>4.5 (11%)</td>
</tr>
<tr>
<td>(2.9,4.5)</td>
<td>7 (17%)</td>
<td>8 (20%)</td>
<td>20 (49%)</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>Total Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 203</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.9,3)</td>
<td>45.5 (22%)</td>
<td>53 (26%)</td>
<td>63.5 (31%)</td>
<td>41 (20%)</td>
</tr>
<tr>
<td>(2.9,4.5)</td>
<td>32 (16%)</td>
<td>40 (20%)</td>
<td>77 (38%)</td>
<td>54 (27%)</td>
</tr>
</tbody>
</table>

The tabular representation shows that the preferred learning style for the total sample is that of the Diverger when using both axes 2.9; 3 (the mean coordinates for Kolb's general sample) and 2.9; 4.5 (the mean coordinates for Kolb's undergraduate sample). This equates to 31% and 38% of the sample respectively. Regression analysis of the AE-RO/AC-CE was undertaken. While there was no linear correlation in the data it does emphasise the representation of all the learning styles within the total sample and, therefore, substantiates the claim that the sample can be used to represent the novice quantity surveyor.

Analysis of the stages of the Learning Cycle
Lowe and Skitmore

A further regression analysis was carried out on the scores for Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation. The results are presented in table 3 below:

Table 3 Regression analysis of the stages of Kolb's learning cycle (Total sample n = 203)

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>-</td>
<td>0.032</td>
<td>-0.383</td>
<td>-0.213</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.005</td>
</tr>
<tr>
<td>RO</td>
<td>0.032</td>
<td>-</td>
<td>-0.211</td>
<td>-0.559</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>p&lt;0.005</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>-0.383</td>
<td>-0.211</td>
<td>-</td>
<td>-0.194</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.005</td>
<td>p&lt;0.005</td>
<td></td>
</tr>
<tr>
<td>AE</td>
<td>-0.213</td>
<td>-0.559</td>
<td>-0.194</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.005</td>
<td>p&lt;0.001</td>
<td>p&lt;0.005</td>
<td></td>
</tr>
</tbody>
</table>

The results obtained from the total sample show that there was a significant negative regression coefficient for CE/AE, RO/AC, and AC/AE at the 0.5% level and for CE/AC and RO/AE at the 0.1% level. These figures relate closely to those obtained by Kolb (1979, 1981) (see Table 4) who obtained the following intercorrelations of the scale scores for a general population sample of 807 people. (Kolb, 1981)

Table 4 Regression analysis of the stages of Kolb's learning cycle (n = 807)

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>-</td>
<td>0.13</td>
<td>-0.57</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td>0.13</td>
<td>-</td>
<td>-0.19</td>
<td>-0.50</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>-0.57</td>
<td>-0.19</td>
<td>-</td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>AE</td>
<td>-0.02</td>
<td>-0.50</td>
<td>-0.12</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 Mean and standard deviations for the Learning-Style Inventory Scores of the total sample.

<table>
<thead>
<tr>
<th></th>
<th>(CE)</th>
<th>(RO)</th>
<th>(AC)</th>
<th>(AE)</th>
<th>(AC-CE)</th>
<th>(AE-RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/T</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Concrete Experience stage of the learning cycle was significantly underutilised by the combined sample and the full-time and part-time sample 1 students. The second part-time sample produced a score close to the normative mean. The scores for the Reflective Observation stage were significantly above the normative mean for the combined sample and for the three individual samples. The Abstract Conceptualization stage produced a score below the normative mean for the three individual samples and a significantly low score for the combined sample. The Active Experimentation stage produced a score above the normative mean for the part-time sample 1, a slightly above normative mean score for the combined sample and the full-time student sample and an average score for the part-time sample 2. The mean and standard deviations for the learning styles inventory scores can be compared with those produced by Kolb (see Table 6).

### Table 6 Learning-Style Inventory Scores for people whose undergraduate college majors were in the arts, social sciences and physical sciences (Kolb 1984, p 87)

<table>
<thead>
<tr>
<th></th>
<th>(CE)</th>
<th>(RO)</th>
<th>(AC)</th>
<th>(AE)</th>
<th>(AC–CE)</th>
<th>(AE–RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Arts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 137</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{X} )</td>
<td>15.41</td>
<td>14.20</td>
<td>16.69</td>
<td>15.11</td>
<td>1.31</td>
<td>0.96</td>
</tr>
<tr>
<td>SD</td>
<td>3.26</td>
<td>3.35</td>
<td>3.68</td>
<td>3.37</td>
<td>6.18</td>
<td>5.95</td>
</tr>
<tr>
<td><strong>B. Social Science</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 169</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{X} )</td>
<td>14.26</td>
<td>12.75</td>
<td>18.05</td>
<td>16.09</td>
<td>3.86</td>
<td>3.31</td>
</tr>
<tr>
<td>SD</td>
<td>3.35</td>
<td>3.68</td>
<td>3.67</td>
<td>3.43</td>
<td>6.23</td>
<td>6.37</td>
</tr>
<tr>
<td><strong>C. Physical Science</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 277</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{X} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Preferred Learning Style

The preferred learning style of the novice quantity surveyor is that of the Diverger. The mean scores for the AE-RO and AC-CE co-ordinates of (1.70, 2.81) falls within the quadrant of the Diverger style, when the axis is based on both general samples produced by Kolb. The co-ordinates relate very closely to the mean for the AC-CE, while the score for the AE-RO differs from the normative average due to the above average score for Reflective Observation. This style has been defined by Kolb et al., (1979) as "The diverger has the opposite learning strengths of the converger. This person is best at concrete experience (CE) and reflective observation (RO). This person's greatest strengths lies in imaginative ability. This person excels in the ability to view concrete situations from many perspectives. We have labelled this style "diverger" because a person with this style performs better in situations that call for the generation of ideas, such as a "brainstorming" idea session. Research shows that divergers are interested in people and tend to be imaginative and emotional. They have broad cultural interests and tend to specialize in the arts. Counsellors, organization development specialists, and personnel managers tend to be characterised by this learning style". (p 41) This is supported by both the mean co-ordinates and the mode for the preferred learning style. The co-ordinates produced for the individual samples and the combined sample are all relatively close to the axes produced by Kolb, especially on the AC-CE axes. The above description by Kolb must therefore be tempered. The mean co-ordinates of 1.7; 2.81 can be used to assess the divergence of the expert pre-tender estimators from the preferred learning style of the novice quantity surveyor.

Application of the Stages of the Learning Cycle

The order of importance attached to the stages of the learning cycle in descending order is Reflective Observation, Active Experimentation, Abstract Conceptualization, and Concrete Experience when compared to the normative mean scores. This places importance on reflection and experimentation rather than on concepts and experience as supported by the preferred learning style above. The above average score in Reflective Observation is perhaps to be expected due to the nature of study undertaken by the sample. To quote Kolb et al., (1979) "a high score on reflective observation indicates a tentative, impartial, and reflective approach to learning. High-RO individuals rely heavily on careful observation in making judgements, and prefer learning situations such as lectures that allow them to take the role of impartial objective observers. These individuals tend to be introverts". (p 40) The below average score in Concrete Experience for the full-time students reflects their mode of study. However, the below average score for the year 3 and 4 part-time students in sample 1 was unexpected. The average score for this learning stage in year 5 of sample 1 and sample 2 suggests an increasing utilisation of this stage with time. The scores for the final year full-time students and both the part-time samples for the Active Experimentation stage of the learning cycle indicates an average or above average utilisation.
Experiential factors and the "expert" pre-tender estimator

Ten practising pre-tender cost estimators were interviewed in order to assess whether or not they were adopting the theoretical aids that improved learning from experience. All the interviewees were corporate members of the Royal Institution of Chartered Surveyors, Quantity Surveying Division. The mean age of the estimators was 43.3 (39 when the two eldest participants were excluded) and the mode and median were 38. From the analysis of the interview transcripts the following conclusions were drawn:

- While only half the sample considered themselves to be "expert" pre-tender estimators there was generally a high self regard for their estimating capabilities.

- All the interviewees considered their experiences to be a contributory factor in their development as an estimator.

- Initially the estimators were unable or reluctant to give any specific examples of the experiences that have aided their development. This supports the view of Kidd and Welbank (1984) that "humans find it difficult to articulate what knowledge they have... [and]... the more expert someone becomes at a task, the more "unconscious" his knowledge becomes". After specific questioning the knowledge obtained by experiential learning appears to relate to the following factors:
  - Location - the effects of the location of a proposed project on the pre-tender estimate.
  - Clients - past experiences of clients in order to establish their likely "preferences and prejudices".
  - Architects - past experience of individual architects in order to establish their "attitudes and preferences".

It is interesting to note that Brandon et al. (1988) consider the limitations of expert systems to be their inability to assess past experiences of the client and the knowledge of the clients architect, to establish likely preferences and prejudices.

- The majority (eight) of the "expert" pre-tender estimators considered negative experiences to be the most effective aid to development, while one estimator considered it to be positive experiences and one considered them both to be equally beneficial. This supports Handy's (1985) assertion that it is easier to learn from failure than success, Bannister and Fransella's (1971) statement that "the experience of being "wrong" is educationally as important as the experience of being right" and the view of Klien (1989) that failure is essential to learning. Of those estimators that considered negative experiences to be more beneficial several equated the term negative with getting an estimate wrong or making mistakes, being caught out or painful. There seemed with some of the estimators a reluctance to admit to making mistakes.
The "expert" pre-tender estimators were, on the whole, unable to adequately explain how they learnt from experience. The majority of the estimators "trust to luck" in learning from their mistakes, relying on the unpleasant experience to act as an aide-memoir in future similar situations. Another factor that emerged was the desire to be able to justify their professional judgement when errors occurred. This would appear to be a negative reaction to a negative experience and therefore not an ideal response.

The "expert" pre-tender estimators underutilised the reflective learning style. The ability to critically reflect on experiences appears to be a significant factor in learning from experience. Theoretical considerations suggest that "true experts" would be proficient at the reflective stage of the learning cycle. Despite Boud and Walker's (1985) comment that the skill of reflection is the one most people are deficient in, four of the estimators stated that they do reflect. The remainder either didn't reflect or only did so when an estimate was "wrong". This supports the view of Casey (1983a) that "one condition for learning which is not necessarily present... is the regular opportunity to pause and reflect before having another go". However as Handy (1990) states "success without prior thought or subsequent reflection does not help you to repeat the process or improve on it". The estimators are, therefore, missing an important opportunity to learn from experience.

The majority of estimators discussed their estimates with colleagues. As Gibbs (1988) considers that peer appraisal, structured discussion/debriefing enhances learning from experience and Garratt (1983) suggests that adults learn best from the constructive criticism of colleagues, it is interesting to note the responses to the above question. It would appear that all the estimators consider the discussion of estimates with colleague to be important, while most saw the merit of discussing the comparison of estimates with tenders received.

With the exception of two "expert" pre-tender estimators, there was a lack of self analysis of the results of estimates which would have resulted in self assessment and dissemination of information within the individuals practice. Several educationalists consider the use of formal records of experience to be a valuable aid to reflection and therefore experiential learning. Glaser and Chi (1988) state that experts have strong self-monitoring skills and Ogunlana (1989) suggests that failure to learn derives from the absence of a system for monitoring estimating performance and concludes that the incorporation of feedback techniques represents a potential force for improving accuracy. Only two of the "expert" estimators used the formal logging of estimates as an aid to reflection. The interviewees were asked whether they saw any benefit in the introduction of a system of self-assessment. On the whole the interviewees conceded that their introduction would be beneficial.

A preference for the "expert" pre-tender estimators to adopt an analytical and practical approach to preparing an unfamiliar estimate was revealed with several
mentioning the production of approximate quantities. This corresponds to the responses to Skitmore et al's (1990) survey where most subjects considered themselves to be logical and systematic. One interviewee, however, considered a mixture of all four stages of the learning cycle to be appropriate, while six thought a combination of two approaches to be appropriate.

- Handy (1990) suggests that fright, new faces, new questions, new structures, new goals or standards prompted change. Generally the interviewees were confident of their current estimating practice. This confirms Ogunlana's (1989) findings that there is an "illusion of validity, of the generally held view that estimating performance is good enough" or to quote Claxton (1984) the "non-appearance of desirable consequences". They did, however, agree that the most likely factor to prompt change would be client dissatisfaction. Three estimators mentioned the requirements of quality assurance and one referred to the introduction of ELSIE.

- Despite the fact that openness to experience is held to be a significant factor in learning from experience (Gibbs, 1988) there was a general feeling of complacency and a reluctance to change, in the responses of the "expert" pre-tender estimate, the factors most likely to prompt change, and therefore experiential learning, were client dissatisfaction and the introduction of quality assurance. This illustrates the view of Handy (1990) that most people do not like change, change is forced upon them by crisis and discontinuity. It also supports the findings of Ogunlana (1991) that "unless an event occurs that brings inaccurate predictions to the attention of the estimator, the need for learning will not be recognised. Events that threaten the project or the estimator will result in the recognition of the need for learning".

- Another factor which determines the effectiveness of experiential learning at work concerns the working environment, whether or not individuals are encouraged to develop. Apart from three of the interviewees, there appeared to be a desire to encourage the personal development of staff, especially towards professional qualifications. Beyond this, however, it seems to be down to the individual to request further development, particularly the attendance of seminars etc. Only two interviewees worked for practices where a formal staff development policy existed. The majority, therefore, falling below the requirements of the ideal working situation described by Honey and Mumford (1989a).

- There was a general lack of knowledge of how to improve their estimating performance by implementing theoretical means of enhancing experiential learning.

"Expert" pre-tender cost estimator's preferred learning style

In addition to the semi-structured interviews the "expert" pre-tender estimators were asked to complete Kolb's Learning-Style Inventory, Honey and Mumford's Learning Style Questionnaire and Juch's Learning Profile Questionnaire.
Preferred Learning Style

Kolb's Learning-Style Inventory

The distribution of the learning style preferences for the "expert" pre-tender estimators based on Kolb's "Learning Style Type Grid" which has as its axes 2.9; 3 is tabulated in Table 7 and compares the axes of 2.9; 4.5 (Kolb's mean co-ordinates for graduates) and 1.7; 2.8 (the mean co-ordinates produced by the novice quantity surveyors).

Table 7 Distribution of "expert" pre-tender estimators learning styles based on Kolb.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Assimilator</th>
<th>Converger</th>
<th>Diverger</th>
<th>Accomodator</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2.9,3)</td>
<td>2.5</td>
<td>1</td>
<td>0.5</td>
<td>6</td>
</tr>
<tr>
<td>(2.9,4.5)</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>(1.7,2.8)</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

The tabular representation suggests that the preferred learning styles of the "expert" pre-tender estimator fall predominantly within the opposing quadrants of Assimilator and Accomodator with most of estimators favouring the Accomodator style. This is the case when all the axis are applied and equates to 60%, 70% and 60% of the sample respectively and this is supported by both the mean co-ordinates and the mode for the preferred learning style. Regression analysis of AE-RO/AC-CE was undertaken. While statistically there is no significant correlation in this data the negative "r" value however, confirms the link between the styles of Assimilator and Accomodator.

An Accomodator has been defined by Kolb et al., (1979) as "This person is best at concrete experience (CE) and active experimentation (AE). This person's greatest strength lies in doing things - in carrying out plans and experiments - and in involving oneself in new experiences. This person tends to be more of a risk taker than people with the other three learning styles. We have labelled this person "accomodator" because this person tends to excel in those situations where one must adapt oneself to specific immediate circumstances. In situations where a theory or plan does not fit the "facts", this person will most likely discard the plan or theory. This person tends to solve problems in an intuitive trial and error manner, relying heavily on other people for information rather than on one's own analytical ability. The Accomodator is at ease with people but is sometimes seen as impatient and "pushy". This person's educational background is often in technical or practical fields such as business. In organizations people with this learning style are found in "action-oriented" jobs, often marketing or sales". (p 42)

Honey and Mumford's Learning Style Questionnaire

The learning style preferences of the "expert" pre-tender estimators based on Honey and Mumford's learning style questionnaire can be considered under their stages of the learning cycle i.e. Activist (CE), Reflector (RO), Theorist (AC) and Pragmatist (AE).
Experiential Learning: The Development of an Expert Pre-tender Estimator

**Activist:** Four estimators were found to have a very strong preference, two a strong preference, two a moderate preference and two a low preference for this learning style. The mean score of 11.2 equates overall to a strong preference.

**Reflector:** Three estimators were found to have a very strong preference, one a strong preference, two a moderate preference, three a low preference and one a very low preference for this learning style. The mean score of 14.2 equates overall to a moderate preference.

**Theorist:** Six estimators were found to have a very strong preference, three a strong preference and one a low preference for this learning style. The mean score of 16 equates overall to a very strong preference.

**Pragmatist:** Five estimators were found to have a very strong preference, three a strong preference and two a moderate preference for this learning style. The mean score of 16.4 equates overall to a very strong preference.

The preferred learning style of the "expert" pre-tender estimator, according to Honey and Mumford, is not as conclusive. The estimators have a very strong preference for the Theorist style and a strong preference for the Pragmatist and Activist styles. Honey and Mumford have defined the Theorist stage as "Theorists adapt and integrate observations into complex but logically sound theories. They think problems through in a vertical, step by step logical way. They assimilate disparate facts into coherent theories. They tend to be perfectionists who won't rest easy until things are tidy and fit into a rational scheme. They like to analyse and synthesize. They are keen on basic assumptions, principles, theories, models and system thinking. Their philosophy prizes rationality and logic. Questions they frequently ask are: "Does it make sense?" "How does this fit with that?" "What are the basic assumptions?"".

**Analysis of the stages of the Learning Cycle**

*Kolb*

A further regression analysis was carried out on the scores for Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation. The results are presented in table 8 below:

Table 8 Regression analysis of the stages of Kolb's learning cycle ("Expert" pre-tender estimators, n = 10)

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td></td>
<td>-0.161</td>
<td>-0.209</td>
<td>-0.184</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>RO</td>
<td>-0.161</td>
<td></td>
<td>0.094</td>
<td>-0.421</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
The results obtained from the "expert" estimators suggested that there was a negative regression coefficient for AE/RO and AC/CE but that this was not significant. There was, however, a significant negative regression coefficient for AC/AE at the 2.5% level. These figures do not relate to those obtained by Kolb for the general sample (see Table 4).

Table 9 Learning-Style Inventory Scores for the "expert" pre-tender estimator (n = 10) compared to the novice quantity surveyor (n = 203)

<table>
<thead>
<tr>
<th>Expert</th>
<th>(CE)</th>
<th>(RO)</th>
<th>(AC)</th>
<th>(AE)</th>
<th>(AC-CE)</th>
<th>(AE-RO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.8</td>
<td>12.5</td>
<td>17.1</td>
<td>17.6</td>
<td>1.3</td>
<td>5.1</td>
</tr>
<tr>
<td>SD</td>
<td>1.536</td>
<td>2.837</td>
<td>2.427</td>
<td>2.764</td>
<td>3.132</td>
<td>4.721</td>
</tr>
</tbody>
</table>

Novice QS

|        | 2.540 | 3.768 | 2.840 | 3.434 | 4.462   | 6.359   |

The Concrete Experience stage of the learning cycle is slightly above the normative mean indicating a tendency for the "expert" pre-tender estimator to "learn from specific examples in which they can become involved... and benefit most from feedback and discussion with fellow CE learners". (Kolb et al., 1979 p 40) Concrete Experience also produced the smallest deviation from the mean. The results illustrate a significant increasing reliance by the estimators on this learning stage compared to the below average score obtained from the novice quantity surveyors. The "experts" low score for Reflective Observation, compared to the normalised mean and the high reliance on reflection by the novice quantity surveyors, represents an underutilisation of this stage of the learning cycle by the "experts". The "expert" estimators score for the Abstract Conceptualization stage of the learning cycle equates to an average score when compared to the normalised mean. The "experts" highest scoring stage was that of Active Experimentation which is well above the normative average, indicating a tendency for the "expert" estimators to rely upon this style. To quote Kolb et al. (1979) "a high score on active experimentation indicates an active, "doing" orientation to learning that relies heavily on experimentation. High-AE individuals learn best when they can engage in such things as projects, homework, or small group discussions. They dislike passive learning situations such as lectures. These individuals tend to be introverts". (p 40) These scores confirm the declared preference for the "expert" estimators to "do" rather than "reflect" when preparing pre-tender estimates. The mean scores for the AC-CE and AE-RO co-ordinates are 1.3; 5.1 which fall within the quadrant of the Accommodator style when the axis is based on both general samples produced by Kolb and the mean scores of
the novice quantity surveyor. The AC-CE score is below the normative average due to the Concrete Experience score for the "expert" estimator being slightly higher than the average, while the AE-RO is higher than the normative average due to the above average score in Active Experimentation and the below average score in Reflective Observation. This compares favourably with the findings of Kolb et al., (1979) among people with high pressure management jobs whom he found "select and develop active experimentation learning skills and inhibited reflective observation skills". (p 47)

The order of importance attached to the learning cycle in descending order are Active Experimentation, Concrete Experience, Abstract Conceptualization and Reflective Observation when compared to the normative mean scores. This places importance on doing and experience rather than concepts and reflection. The use of Kolb's Learning Style Inventory with the "expert" estimators produced an above average score for Active Experimentation, a slightly above average score for Concrete Experience, an average score for Abstract Conceptualization and a slightly below average score for Reflective Observation. These scores support the qualitative data generated by the semi-structured interviews. When compared to the results obtained from the novice quantity surveyor this indicates an increased utilisation of the Concrete Experience stage and a decreased use of the Reflective Observation stage with time.

Honey and Mumford

A further regression analysis was carried out on the scores for Activist (Concrete Experience), Reflector (Reflective Observation), Theorist (Abstract Conceptualization) and Pragmatist (Active Experimentation). The results are presented in table 10 below:

Table 10 Regression analysis based on the stages of Honey and Mumford's learning cycle

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>-</td>
<td>-0.018</td>
<td>0.135</td>
<td>0.396</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>RO</td>
<td>-0.018</td>
<td>-</td>
<td>0.488</td>
<td>0.314</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>AC</td>
<td>0.135</td>
<td>0.488</td>
<td>-</td>
<td>0.619</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>p&lt;0.025</td>
</tr>
<tr>
<td>AE</td>
<td>0.396</td>
<td>0.314</td>
<td>0.619</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>n.s.</td>
<td>n.s.</td>
<td>p&lt;0.025</td>
<td>-</td>
</tr>
</tbody>
</table>

The results obtained from the expert pre-tender estimators suggested that there was a significant positive regression coefficient for AC/AE at the 2.5% level. The analysis of AE/RO and AC/CE proved not to be significant and produced, in this instance, a positive regression coefficient.
Table 11 Learning Style Questionnaire Scores for the "expert" pre-tender estimator (n = 10) compared to the normative averages obtained by Honey and Mumford and Kolb

<table>
<thead>
<tr>
<th></th>
<th>Activist (CE)</th>
<th>Reflector (RO)</th>
<th>Theorist (AC)</th>
<th>Pragmatist (AE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>X</td>
<td>11.2</td>
<td>14.0</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>2.993</td>
<td>4.423</td>
<td>2.966</td>
</tr>
<tr>
<td>Honey &amp; Mumford</td>
<td>X (Norm)</td>
<td>9.3</td>
<td>13.6</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

The above results compare favourably with the results obtained using Kolb's Learning-Style Inventory. The scores are not directly comparable, however, as the range for Honey and Mumford's questionnaire is 0 to 20, whereas for Kolb's inventory the range is 6 to 24. Also the scoring of Honey and Mumford's questions is independent, while Kolb and Juch use a comparative ranking system of 4 and 3 word choices respectively. The results confirm the lack of importance shown by the "expert" pre-tender estimators for the Reflector (RO) stage of the learning cycle which obtained an average score compared to the very strong preference towards the Theorist (AC) stage and a strong preference for the Pragmatist (AE) and Activist (CE) stages of the learning cycle. This second questionnaire, while adopting a different mechanism for assessing the preferred learning styles, i.e. agreeing or disagreeing with ten separate questions for each learning style, produced similar results. The mean scores for the "expert" estimators when compared to the normalised scores obtained by Honey and Mumford suggest a very highly significant preference for the Theorist (AC) stage, a highly significant preference for the Pragmatist (AE) and Activist (CE) stages and no significant difference for the Reflector (RO) stage. While the results do not match exactly those obtained using Kolb's Learning Style Inventory it does indicate once again the importance of the Abstract Conceptualization, Active Experimentation and Concrete Experience stages and highlights the low position of Reflective Observation within the "expert" estimators learning style.

When the above results are compared with those obtained by Lansley (1987) for general construction professionals (see Table 12) they show a significant increase in the use of the Activist style, a slight increase in the Theorist and Pragmatist styles and an identical result for the Reflector stage.

Table 12 Comparison of Norms for Construction Managers and Professionals with those for a Wide Cross Section of Other Managers and Professionals in the UK Industry (Lansley 1987)

<table>
<thead>
<tr>
<th></th>
<th>Activist</th>
<th>Reflector</th>
<th>Theorist</th>
<th>Pragmatist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>(n = 104)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Experiential Learning: The Development of an Expert Pre-tender Estimator

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S.D.</th>
<th>Others</th>
<th>n = 1302</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.7</td>
<td>2.9</td>
<td>9.3</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td>2.8</td>
<td>13.6</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>14.5</td>
<td>2.6</td>
<td>12.5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>2.6</td>
<td>13.7</td>
<td>2.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>&quot;t&quot;</th>
<th>prob</th>
<th>&quot;t&quot;</th>
<th>prob</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1.99</td>
<td>&lt;5.0%</td>
<td>6.27</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>&lt;20.0%</td>
<td>4.4</td>
<td>&lt;0.1%</td>
</tr>
</tbody>
</table>

Juch's Learning Profile Questionnaire

Unfortunately the data obtained using Juch's learning profile questionnaire is not directly comparable to that obtained using Kolb's Learning-Style Inventory as Juch's scores have a range of 0 to 24 compared to 6 to 24 for Kolb. The results do, however, reveal several discrepancies between those obtained using Kolb's Learning Style Inventory and those from Honey and Mumford's Learning Style Questionnaire. The Sensing (RO) stage obtains the highest mean score while the Thinking (AC) stage generates the lowest score. As Juch does not publish any normative results these scores cannot directly be compared with the other two samples. The order of importance attached to the stages of the learning cycle in descending order is Sensing (RO), Doing (CE), Planning (AE) and Thinking (AC). However, due to the discrepancies that became evident when using Juch's Learning Profile Questionnaire it is inappropriate to make comparisons between these results and the above.

Analysis of the ranking of individual words, questions and expressions

Analysis of the ranking of the individual words, questions and expressions was undertaken to assess their importance to the "expert" pre-tender estimator.

**Kolb**

The word "experience" scored the highest with all but one estimator ranking it at 4. This corresponds to the work of Skitmore (1985, 1990) in confirming the perceived importance of experience to the "expert" pre-tender estimator. Other words such as "evaluative", "practical", "active", "logical" and "pragmatic" were all used during the interviews by the estimators. The word "tentative" obtained the lowest score. Other reflective words such as "reserved", "watching", and "reflecting" appears to confirm the low Reflective Observation score overall. It is worth noting that words such as "intuitive" and "analytical" appear obtained low scores

**Honey and Mumford**

The "expert" estimators all ranked questions 5, 11, 28, and 38 as (2). These questions relate to the words "practical", "evaluative", "realistic" and "methodical". All but one estimator ranked questions 1, 8, 10, 2, 14, 30, 3, 20, 26, 34, and 35 as (2). These questions relate to the factors of "risk taking", "methodical", "interpreting", logical", "concepts", "objective", "direct", "practical", and "pragmatic". Again these factors confirm the declared learning
style preferences and the results of the analysis of Kolb's Learning-Style Inventory that the estimators would rather "do" than "reflect". The estimators all ranked question 12, the preference of unusual ideas to practical ones with a 0. Other factors that ranked lowest related to the words "experimentation", "thinking", "feelings", present-orientation", "intuitive", "watching", and "observing". This again confirms the estimators low preference for the Reflector (RO) stage of the learning cycle.

Juch

A further problem arose when the factors used for the stages of the learning cycle were investigated. Whereas the words and questions of Kolb's Learning Style Inventory and Honey and Mumford's Learning Style Questionnaire are comparable, Juch has used several words in his Doing (CE) stage that Kolb considers to be in Abstract Conceptualization (AC) and several in the Planning (AE) stage that Kolb considers to be in Concrete Experience (CE). While, therefore, the individual ranking of Juch's expressions generally corroborate the ranking of Kolb's and Honey and Mumford's data the mean scores obtained for the learning cycle stages cannot be said to prove or disprove the earlier results, despite the fact that they are of interest.

Summary

The common expressions that reflected the preferred learning style of the "expert" estimator are; "practical", "evaluative", "realistic", "experience", "logical" and "pragmatic". The common expressions that least reflected their preferred learning style are; "experimenting", "reflecting", "watching", "intuitive", "observing" and "feeling". One factor which only appeared in Juch's questionnaire but gives cause for concern is the very low score given to "adjusting opinion". Despite the discrepancies in the general definition of the learning style for the "expert" pre-tender estimator, the analysis of the responses to the individual words, questions and expressions reveals a consistency in their response. This could be a result of the following, to quote Kolb (1984), "one's professional career choice not only exposes one to a specialised learning environment; it also involves a commitment to a generic professional problem ..., that requires a specialized adaptive orientation. In addition, one becomes a member of a reference group of peers who share a professional mentality, a common set of values and beliefs about how one should behave professionally. This professional orientation shapes learning styles through habits acquired in professional training and through the more immediate normative pressures involved in being a competent professional". (p 88)

Conclusion

This paper set out to examine the relationship between the preferred learning styles of novice quantity surveyors and pre-tender cost estimator.

• The preferred learning style of the novice quantity surveyor was established, using Kolb's Learning Style Inventory, as that of the Diverger. The order of importance attached to the stages of the learning cycle in descending order Reflective
Experiential Learning: The Development of an Expert Pre-tender Estimator

Observation, Active Experimentation, Abstract Conceptualization and Concrete Experience when compared to the normative mean scores.

• The preferred learning style of the "expert" pre-tender estimator was established, using Kolb's Learning Style Inventory, as that of the Accomodator. The preferred learning style obtained by using Honey and Mumford's Learning Style Questionnaire was inconclusive, although the estimators were found to have a very strong preference for the Theorist style and a strong preference for the Pragmatist and Activist styles.

• The use of Kolb's Learning Style Inventory produced an above average score for Active Experimentation, a slightly above average score for Concrete Experience, an average score for Abstract Conceptualization and a slightly below average score for Reflective Observation. The mean scores obtained using Honey and Mumford's Learning Style Questionnaire suggest a very strong preference for the Theorist (AC) stage, a strong preference for the Pragmatist (AE) and Activist (CE) stages and a moderate preference for the Reflector (RO) stage. While the two sets of results do not match exactly they do indicate the importance of the Abstract Conceptualization, Active Experimentation, and Concrete Experience stages and highlight the low position of reflection within the "experts" pre-tender estimators learning style. When compared to the results obtained from the novice quantity surveyor this indicates an increased utilisation of the Concrete Experience stage and a decreased use of the Reflective Observation stage with time.

• Despite the fact that several educationalists consider the use of formal records of experience to be a valuable aid to reflection, and therefore experiential learning and Glaser and Chi's (1988) statement that experts have strong self-monitoring skills the research revealed that only two of the "expert" pre-tender estimators used the formal logging of estimates as an aid to reflection. This once again supports the suggestion of Ogunlana (1989) that failure to learn derives from the absence of a system for monitoring estimating performance and his conclusion that the incorporation of feedback techniques represents a potential force for improving accuracy.

• It would appear that in order to produce the "ideal learner" in a novice quantity surveyor requires specific training in "how to learn" effectively from experience. The failure of estimators to implement effective feedback techniques should be addressed by encouraging novice quantity surveyors to reflect on their experiences, implement self-monitoring and assessment of their estimating performance and to persuade them of the benefits of an effective feedback mechanism. Likewise the identification of those areas of knowledge obtained through experiential learning and their importance in the application of professional judgement is necessary to enable the novice quantity surveyors to monitor these factors and thereby improve their accuracy in estimating.

• It would appear that specific training in how the estimator can learn from experience is required. The "expert" pre-tender estimator's low overall performance in the Reflective Observation stage of the learning cycle needs to be addressed, in order to
Lowe and Skitmore

produce estimators who can capitalise on the learning opportunities present in their working environments. Introducing estimators to ways of improving their experiential learning must, therefore, provide a mechanism for improving estimating accuracy. The review of experiential learning suggested that these could comprise the use of portfolios, journals, discussion with others, debriefing, collaboration, behaviour records, reflective analysis and convergent thinking. The introduction of experiential learning theory, however, must address the problems of working environments and the lack of openness to change exhibited by the "expert" pre-tender estimators. If the estimators are not prepared to question their methods and working practices, or be encouraged to by their employers, little improvement will be gained.

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