An approach for promoting knowledge exchange on production practices through the internet

Aguinaldo Santos, Universidade Federal do Paraná, Curitiba, Paraná, Brazil (asantos@cesec.ufpr.br)

Sergio Scheer, Universidade Federal do Paraná, Curitiba, Paraná, Brazil (scheer@ufpr.br)

John Hinks, Center for Advanced Built Environment Research, Glasgow, Scotland (j.Hinks@caber.fsbusiness.co.uk)

Summary

Recent research shows that that current learning strategies in construction have not been effective in implementing lean principles in construction (Santos, 1999). With that in mind the researchers set to investigate an alternative learning strategy in order to promote learning at the international level. A web-based environment, was developed for this project with the intent of promoting learning and knowledge exchange on the theory and practice of "process transparency" across different countries. The novelty in the method for promoting knowledge exchange was the requirement of a case study from each participant in order to allow the collaborator to move to the next sections of the web environment. Access to international case studies on process transparency was presented as the main advantage for participating in the project. This experiment prove to be an effective strategy to promote learning and international knowledge transfer.

Keywords: pull learning, process, transparency, knowledge exchange, knowledge transfer, web-based learning

1 Introduction

Recent research shows that current learning strategies in construction have not been effective in implementing lean principles in construction (Santos 1999). With that in mind the researchers set to investigate an alternative learning strategy in order to promote learning at the international level. The reason for an international dimension of the study was twofold: the scattered application of lean construction unveiled in previous studies and the fact that Internet international collaboration.

A web-based environment, was developed for this project with the intent of promoting learning and knowledge exchange on the theory and practice of "process transparency" across different countries. This web-based environment contained six main sections. The initial section presented the abstract meaning of transparency whilst the other sections presented each of the heuristic approaches for implementing this lean principle.

Participants from ten different countries have been invited for the first trial of this environment. The novelty in the method for promoting knowledge exchange was the requirement of a case study from each participant in order to allow the collaborator to move to the next sections of the web environment. Access to international case studies on process transparency was presented as the main advantage for participating in the project. A declaration confirming their involvement in the project was also used as an instrument to promote their commitment to the project.

The next sections present the content of this learning exchange as well as an analysis on the main results achieved in this first trial.

2 Two opposite paradigms on learning

The principal aim of this piece of work is to understand how to create the motivation within the WEB in such that people effectively learns lean production principles. This section reviews the relevant aspects of learning theory for this study.

2.1 "Push learning"

"Push learning" happens when learners have no power in defining the problem, action or knowledge that is required to improve their own process performance. Individual learners are in charge of their actions, while an external change agent (e.g. consultant) is in charge of observing and reflecting on the consequences of the actions. The change agent is also responsible for planning further actions to influence the learning and the situation based on newly formed or reformed understanding. The expert skills of the change agent and his/her clear guidance may provoke a "learning mood" among production personnel. However, in such a situation the change agent is the sole "solution provider" and retains most of the intellectual part of the learning process, as illustrated in Figure 1.

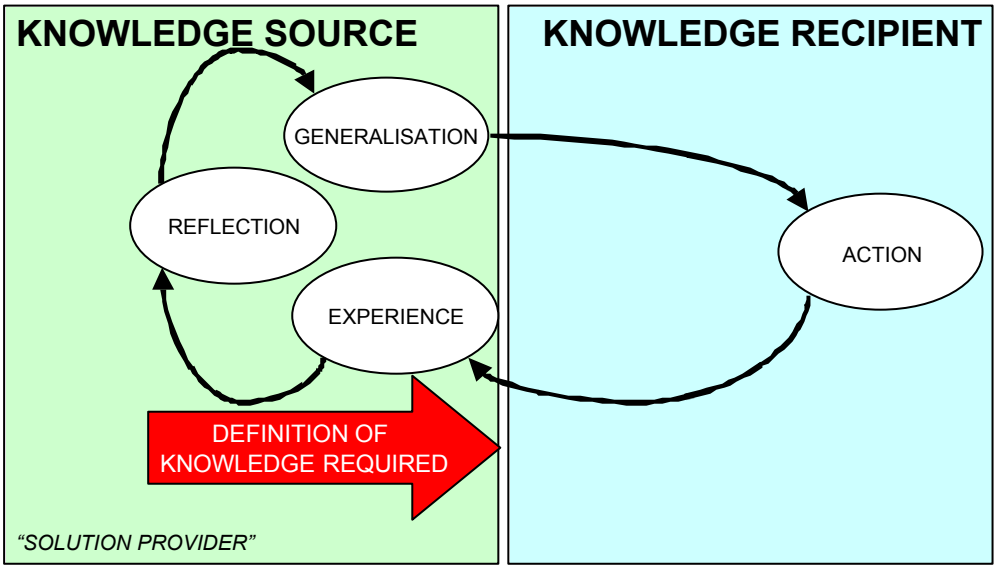

Figure 1 - "Push" Learning Concept

"Push learning" is the common approach used by consultants in conventional working practices in the construction industry in attempt to drive change. Thus, it is also related to traditional academic research projects. Often companies pay consultants or academics to analyse their production technology, or to devise a specific training course. One of the driving forces behind this behaviour is the desire for fast solutions to emergent problems and to get an external agent to do all the analytical work on behalf of the company. In competitive environments, time is not an abundant resource available to a company and answers have to be found quickly before competitors do. Furthermore, contracting production experts (*senseis*) saves costly resources that certainly would be necessary to develop appropriate knowledge. The next example presents a typical example of a "push learning" situation:

"When they arrived at the plant around 10:00 P.M., the Japanese team took one look at the new cell and pronounced it all 'no good'. They explained that among other problems it was laid out backwards (the work should have been flowing counter clockwise) and it would be necessary to move all the machines immediately...'' (Womack and Jones 1996, 129).

The supply of information and advice in a "push" mode has the potential to bring quick increases in performance and radical changes in the way people do things. After all, accurate recognition of the root cause of any problem and the formulation of innovative solutions might never happen if people continue to use the existing knowledge and practices. (Broome 1990) asserts that the introduction of ideas from outside can create unsettlement, but the end result may be beneficial for the company. Writers from the Scientific School already defended the idea of using "trained scientific investigators" since workers could not, by themselves, arrange to work in a more efficient manner (Gilbreth 1911, 91).

Nevertheless, while "push learning" can bring immediate benefits for companies struggling with competition, there are serious doubts concerning the effective development of self-sufficiency among the workforce in the long-term. In other words, there are doubts if this mode of learning makes people capable of continuing to develop, transform or even accept new knowledge long after the training courses and reports have gone.

2.2 "Pull learning"

"Pull learning", on the other hand, happens when individuals have a high control in the definition of the problem, action and knowledge required to improve the performance of their own process. In the "pull learning" situation, the people working in production are in charge of learning for themselves by exploring their actions as they work, as illustrated in

Figure 2. In this situation learners are in charge of their own learning process. Such ownership can lead to higher commitment and motivation for individuals to apply, maintain and improve new ideas in practice.

Experts in this situation change their role from "solution provider" to "knowledge provider" where they have lesser power in the learner's decision making and only play a supportive role in providing knowledge when required. As "knowledge provider" the expert accumulates learning from the process of helping people to solve their problems. However, now the principal aim of the "knowledge provider" is to develop capabilities among people so they can develop their own solutions in future problems.

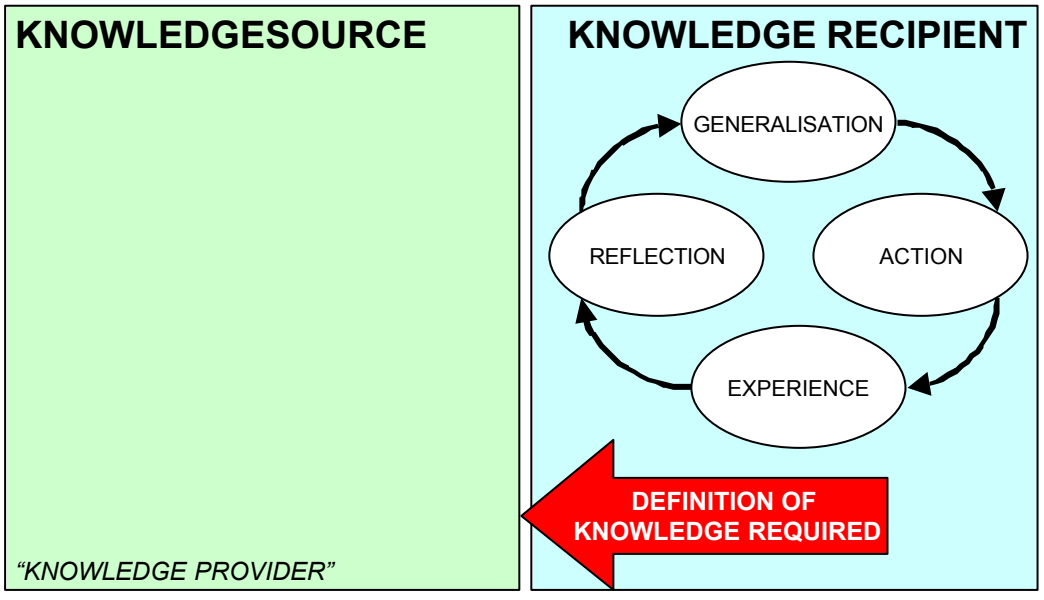

Figure 2 - "Pull" Learning Concept

The "pull learning" approach is defended by the majority of the current literature on learning and change management. (Lessen 1993, 61) recognises that there is less ownership of knowledge if it is forced on learners as opposed to knowledge which people acquire through their own diligent and persevering effort. Likewise, (Senge 1990) asserts that people learn better when they need to learn about something and not when someone else thinks they need to learn.

Nevertheless, consultants, academics and managers often see themselves as experts who are paid to give advice and tell to others what to do. It is rare to witness "experts" helping people to figure out the solution for themselves, even if that involves withholding what may seen to the "experts" as an obvious solution. (Schein 1987) argues that when an expert attempts to get others to do what he/she think they should do, people will resist and often manage to subvert what the expert has offered. One of the reasons for this is the fact that people seeking help or advice often resent being in the role of 'being told'. The person with the problem may well fall down for not being able to stay on top of things (Schein 1987).

3 The focus of our learning exchange: process transparency

The WEB experiment on learning exchange used the production principle of "transparency" as the main theme for discussions. Transparency is one of the foundations of excellence in manufacturing and a fundamental step to construction companies searching for excellence in their production systems and supply chain. Put simply, transparency is defined as the ability of a production process (or its parts) to communicate with people. It is a move from the usual silent production system to a more communicative one (Santos and Hinks 1997). In the strict theoretical sense, transparency means the separation of the information supporting production systems and the physical production itself (Greif 1991, Koskela 1992).

The manufacturing literature shows a vast list of advantages of the implementation of transparency at the organisational and at the operational level such as simplification, motivation, rapid understanding of information and so on (Greif 1991, NKS 1991). In contrast, the construction industry is far behind in the use of this principle. Construction companies usually have few visual mechanisms to inspire, instruct or motivate workers to carry out their jobs more effectively, efficiently and safely.

The traditional conversion model has contributed to this lack of transparency. This traditional mental model understands production systems as a set of conversions of inputs into outputs. Within this model the conversions can be divided into smaller conversion activities and the output of each conversion is associated with the value (or cost) of the inputs. Also, it admits that the optimisation of production systems is obtained through the minimisation of cost of each of those conversion activities (Koskela 1992).

In contrast with the traditional model, other alternative philosophies of Operations Management understand construction as a system composed of 'operation flows' (machine or man) and 'process flows' (information or material), which must generate value to the end customer. This flows, in turn, are composed of processing, waiting, transporting and inspecting activities (Gilbreth 1911, Shigeo 1989, Koskela 1992).

When construction is viewed as a flow many factors that before were considered unimportant, come to the surface and become very important to the production effectiveness. Thus, the flow have to be easy to understand, otherwise managers and workers would prefer to came back to the traditional conversion model as soon as they face the enormous amount of information related to the flow model. Therefore, the production activities have to be more transparent in order to make this model viable. The next sections discuss the various approaches for implementing transparency on production systems in the construction industry.

4 Main results

The results have been extremely good and have opened possibilities for extending the experience to other principles of lean construction.

Figure 3 shows an example of case study presented by one collaborator from Japan, currently studying in the USA. It shows a clear understanding on the content presented over the web. This shared understanding enables this participant to communicate better with other researchers and practitioners participating in the project around the world. The case study supplied to the learning exchange also help future participants to understand more clearly the practical implications of the theory in practice in other cultural and technical contexts.

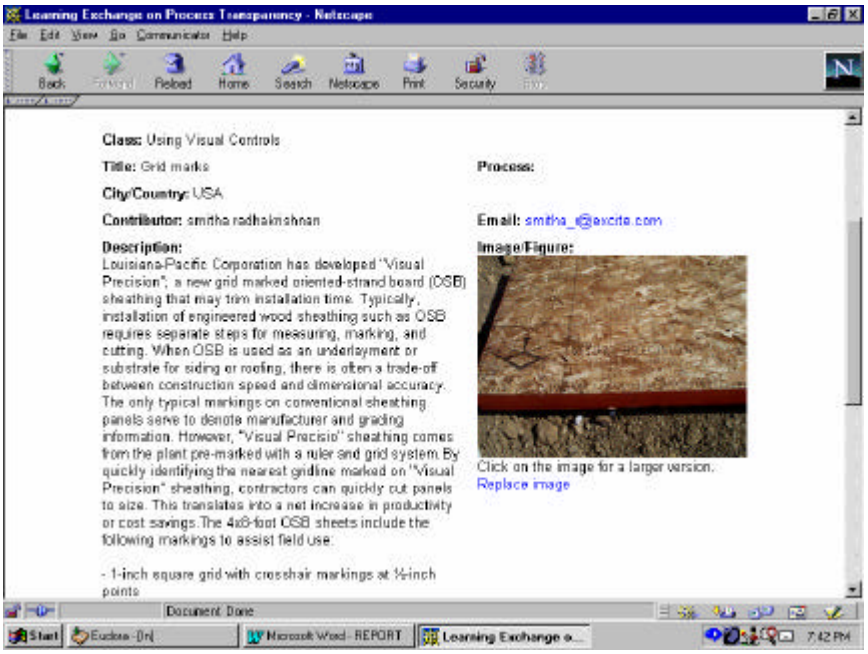

Figure 3 - Example of Contribution of one Participant from Japan

A direct feedback was given to each participant in those situations where a case study but did not match the definition presented to the student. This feedback was also included in the learning exchange in order to avoid that other participants produce the same mistake. The tutor also praised participants presenting excellent case studies.

A total of 30 case studies were submitted during the trial of this learning exchange, suggesting that this is an effective way of promoting international exchange of lean construction practices. However, feedback from the participants suggest that local support and higher control over the speed of contributions to the system need to be addressed in future applications. Hence, we suggest that future experiments on web-knowledge exchange should attempt to use local tutors and use learning exchange projects as part of activities within formal postgraduate or training programs.

5 Conclusion

It was not clear from the literature review what was most suitable approach to initiate an effective learning process through the WEB. The traditional practice of "push learning" adopted in construction industry does not seem to be adequate in WEB learning. "Push learning" appears to be one of the root causes for the persistence of production problems in the sector. Why, for example, are the developments carried out by (Gilbreth 1911) on the bricklaying activity still

not fully implemented in the construction industry? Undoubtedly the problem is not with the knowledge itself since today the most competitive companies intensively apply the same time and motion principles used in that study.

On the other hand, when the imposed changes that characterise "push learning" are compared with "pull learning", it is clear that the major issue is about ownership of the learning process. This ownership is a critical factor in increasing the scope for creativity and imagination among production personnel. On the other hand, approaches to self-directed learning can lead the learners to feel overwhelmed by an infinite number of options and the lack of clear guidance on what to do next. People may have a clear sense that all is not well, or that practice could be improved, but fail to translate their feelings into concrete and precise requests to a "knowledge provider".

The use of abstract principles linked to practical case studies, assembled within a web based learning environment appears to be an effective instrument for enabling the transfer of knowledge across different countries. Indeed, the participants manifested clear understanding on the meaning of the lean principle and correspondent heuristics presented within the learning exchange and that heavily due to the existence of real examples from different parts of the world.

The requirement of a case study as the only way to advance to the next sections within the learning exchange force them into action, therefore characterising an environment of Action Learning (Revans 1982, Revans 1983). The literature does not show common agreement regarding a definition of Action Learning. Action learning is based on individual learning from experience through reflection and action on their own working practices, and then sharing this experience with others who are also learning by experience (Morris 1987, McGill and Beaty 1996). Action Learning follows Kolb's learning cycle (Kolb 1984) where people learn about the world and about themselves through reflection on past actions and plan future actions from reflection on the cumulative understanding of the real world. Based on this argument, we believe that this first trial for the learning exchange was effective on promoting international exchange of knowledge.

6 Acknowledgments

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