Lean Production Training for the Manufacturing Industry: Experiences from Karlstad Lean Factory

Leo J De Vin*, Lasse Jacobsson, JanErik Odhe, Anders Wickberg

Karlstad University, 65188 Karlstad, Sweden

Abstract

Both literature and manufacturing companies state that simulators for providing training in lean production to industrial employees must be similar to the work environment. This motivated the design of Karlstad Lean Factory, which is a training environment that realistically resembles an industrial environment. It is a full-scale training facility that incorporates a combination of materials processing and assembly. Parameters such as processing times, breakdown intervals and repair types can be set. Examples of basic and more advanced training scenarios are given. Experiences from training groups of industrial employees are described; inhomogeneity of these groups requires some specific attention.

© 2017 The Authors. Published by Elsevier B.V.

Keywords: Lean Production; Serious Gaming; Industrial Training; Experiential Learning; Instructional Factory

1. Introduction

Simulation games constitute one group of tools used in lean production training and education. Simulation for training lean production ranges from simple paper-based or LEGO®-based games to larger scale simulation environments, for instance push car assembly. This may be suitable for educating students, but often less so for training industry workers. The latter group typically is more used to intuitive learning than to formal instruction.

* Corresponding author. Tel.: +46547002544.
E-mail address: leo.devin@kau.se
Training this group is facilitated by an environment that more realistically represents the work environment. For this reason, “Karlstad Lean Factory” was created. It emulates industrial materials processing and assembly.

The design and concept of Karlstad Lean Factory were first published in [1] when the lab was still in its development & testing phase. The current paper reports on the first findings of training industrial employees. The purpose of the lab is threefold. Firstly, it is meant as an “instructional factory” (a term coined by Schofield one century ago [2]). Through creating an environment that resembles a factory, a unique facility for training industrial employees and engineering education has been established. The second purpose is to study the effects that the environment has on training industrial employees. The third purpose is to study long-term effects such as transformation of companies (in particular SMEs) to self-learning organizations and increased innovative capacity of SMEs. At this stage, this third purpose is future work.

The disposition of the remainder of this paper is as follows. First, a summary of serious-gaming theory will be presented with a focus on lean production education & training. Next, the motivation for building Karlstad Lean Factory will be summarized and the main features of its equipment will be described. Finally, some of the first findings from training industrial employees will be presented.

2. Serious gaming theory and lean production games

Below, some aspects of serious gaming theory with relevance to game-based lean production training are briefly described. Kolb [3] mentions the existence of a so-called flow channel in game-based learning. If the task is too difficult, then the participant gets frustrated or feels anxiety. If the task is too trivial or too simple, then the participant gets bored. In between, there is a zone in which the participant is engaged in the task. In more recent work [4, 5], this zone is divided into a “gaming zone” (or comfort zone) and a “learning zone” (or challenge zone), see Figure 1, to the left. Learning takes place by zig-zagging between these two zones. This process of zig-zagging is often represented as switching between a gaming cycle and a learning cycle, as shown in Figure 1, to the right (redrawn from [5]). The learning cycle was presented by Csikszentmihályi [6] whereas the gaming cycle is rather similar to Boyd’s cycle (observe, orient, decide, act) which witnesses of its probably military pedigree.

![Fig 1. Flow channel according to Kolb [3] (left) and model used by Koops & Hoevenaar [5] (right)](image)

Garris et al. [7] propose a model for game-based learning that describes learning as input-process-output (Figure 2). With “User Behavior” not just the technical interaction of the user with the (computer) game is meant, but also responses to the game as a whole, such as user attitude and engagement. Hence, “user behavior” is seen to represent a variety of different responses to the game (or task). Probably no single model can fully grasp the complexity of learning [1], and the model from Garris et al. appears to have some limitations when it comes to its suitability to represent lean production games:

- Different participants may, in particular initially, exhibit significantly different responses. Hence, “user characteristics” should be part of the input.
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات