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A Method for Improving Production Management Training by Integrating an Industry 4.0 Innovation Center in China

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Abstract

Production Management is an important issue for organizations that spend considerable amounts of investment annually on personnel training. Especially in the era of Industry 4.0 and Intelligent Manufacturing, considering the exponential growth of new knowledge and information, personnel need to update and supplement the necessary knowledge. Nevertheless, there is a lack of adequate methodology for executing trainings in the field of production management. This paper aims to develop a method for executing production management training which combines online learning and offline training as well as practical parts by using an Industry 4.0 Innovation Center equipped with model devices. A procedure is to first starting with an E-Learning module containing basic knowledge, accessible on the Learning Platform Moodle. Secondly, an on-line survey is created to collect expectations and requirements. Then the training schedule is carried out for execution of professional training. The training part in the innovation center will contribute to build up the basis for adaptations of the training knowledge to practical need of a company. Lastly the test and evaluation is conducted via virtual team room (Vitero). A case study based on training service provider is used to validate the feasibility of the approach. The derived results are presented and conclusions are discussed.

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Keywords: Production Management; Training concept; Industry 4.0; Innovation Center; E-Learning

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1. Introduction

Production management aims to increase enterprise productivity by optimizing the relation between inputs and outputs of a production system [1]. For improving productivity and optimizing the production management system, people need to understand and use concepts or methods such as Lean Manufacturing (LM), Theory of Constraints (TOC), Total Quality Management (TQM), Six Sigma (SS), Total Productive Maintenance (TPM), Kaizen [2]. On top changing new concepts and framework conditions such as Global Production Industry 4.0 and Intelligent Manufacturing require to consider even more concepts and methods [3]. In order to apply the latest technologies of networked production, highly qualified employees as well as open access to technology are essential. As a result, intensive training and continuing education of employees is crucial [4].

However, recent studies have shown that future employees need to adopt teaching curricula in order to cope with increasing industrial requirements [5, 6]. This challenge leads to the requirement for a training provider to design customer-oriented trainings that support the trainees to transfer the knowledge into practice of production management. In this context, the present approach, focuses on how to build a systematic training, including online learning and offline teaching as well as interactive case studies. The main objective is to achieve greater proximity to customer's qualification needs by developing adequate and well-structured trainings. In chapter 2, the state of the art regarding this topic is presented. The present method is elaborated in chapter 3. Afterwards the case study is introduced to validate the presented approach in chapter 4. Finally, chapter 5 concludes with a summary.

2. State of the art

Regarding classical training, a multi-method approach is developed which allows both, real time quality improvement and long term planning [7]. The simulation game is described in the training which points out the need for shop floor management in combination with the new field of Accounting for Lean [8]. However it does not mention how to combine E-Learning with the professional training in production management.

With regard to practice-oriented training, the teaching factory concept is presented which comprises the industrial project, the relevant educational approach and the ICT configuration for the facilitation of interaction between Industry and academia [6, 9]. Instead of lectures and theoretical content the learning factory focuses on problem based learning and interactive tasks [4]. Vin designed a Lean Factory, which is a training environment that realistically resembles an industrial environment [10]. Salas suggested four concepts into training: information, demonstration, practice, and feedback so that training is a systematic process [11]. A multi-criteria resource planning method and tool is presented for optimizing the production, delivery, and installation of Industrial Product Service Systems [12]. A digital and real, energy-efficient, multi-process, networked, manufacturing system is developed for different industries [13]. However, it lacks E-Learning modules as self-preparation. By considering E-learning, the Moodle@UA contains some of the main tools of the standard Moodle platform, like Assignments, Chats, Forums, News and Quiz/Survey [14]. A study about using E-Learning platform in university teaching process is presented [15]. Nevertheless, it lacks of systematical training model for follow-up.

With respect to training curriculum models, the competency models is established which consists of twelve competencies in the three main clusters professional/methodological, social and personal competencies [16]. The new didactical concept is created to impart knowledge regarding the effects on workplaces and labour conditions for employees using a learning factory setting [17]. Billett presented three curriculum models, namely wholly practice-based experiences, practice-based experiences with educational interventions (action learning, action research, project work) and wholly education institution-based experiences [18]. Ganefri put out a production-based learning model, which can improve the students' entrepreneurial interest [19]. In addition, Ganefri and Hidayat created a syntax of production based learning model for vocational education and training via expert validity test with focus group discussion (FGD) [20]. Badea presented the learning process in a collaborative buyer-supplier relationship and the development of shared knowledge, skills and attitudes in supply chain relations, which include four domains and seventeen competencies [21]. However, there is a lack of E-Learning modules as a further option.

As a conclusion drawn from looking into existing approaches for training offers most of them provide different training methodologies as E-Learning, training cycle and practical oriented training center like learning factory.

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