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Teaching Methods-Time Measurement (MTM) for Workplace Design in Learning Factories

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Abstract

Methods-Time Measurement (MTM) has its roots in time studies as a predetermined motion time system. It can however also be used in the field of workplace design and improvement. High amount of work effort for the creation of MTM-analyses and time-consuming trainings in MTM often lead to a decline in the use of MTM.

A potential solution for the human resources management of companies could be practice-oriented trainings with MTM as a method for workplace design. A lot of job profiles (e.g. process engineer) in manufacturing do not need a complete MTM training, as they do not require the full time-study aspect of MTM. This article represents an approach for MTM workplace design training in a learning factory.

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1. Introduction

Companies of the production sector are exposed to drivers like globalisation, which lead to a high amount of challenges, such as customisation of products as well as a reduction of the time-to-market [1]. The latter is determined by the product development within the product creation process [2]. Besides the product development, the process planning, which is to plan and design production systems, has a great influence on the product development. The

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decisions of this planning phase determine the whole production time of a product. This is proved by empirical studies, which show, that the results of the process planning have the second-largest influence on the product costs, just after the product development [3].

The production or working system, which is designed by the industrial engineer, also influences the product's quality and delivery time. An established method to plan and design production systems is Methods-Time Measurement (MTM) [4]. Having its roots in time management, MTM is also enormously helpful to rate work contents and to optimise production systems both prospective (before start of production) and during a running production. However, in industry MTM is not applied comprehensively as the intensive training and the high effort to generate time studies are perceived as obstacles. Yet, for the use of MTM in the field of process planning, a complete education in MTM is not necessary, as the determination of process times, which is mostly done in the division of time management, is not relevant. However, the aspects of optimisation play an important role within the process planning.

A key challenge, facing higher education institutions, is to equip industrial or production engineering students with the skills necessary to secure professional employment in a fast changing and competitive manufacturing environment. This requires such institutions to continuously search for new ways of building competencies and skills. An important aspect with regards to skills development is the method used for the transfer of knowledge. In recent years, more and more research has emphasised the benefits of experiential or action based learning, i.e. learning by doing [5, 6, 7].

Learning factories provide a promising approach to improve production related training through "learning by doing" (or action based learning) by providing a realistic "production" environment as a learning environment - this means processes and technologies inside the learning factory are realistic representations of real industrial sites. Learning factories expose learners to a real-life environment, and allow learners to apply knowledge in a realistic setting. It also provides learners the opportunity to experiment, test and discover, therefore learning by doing and trying. This enhances the learning experience, leads to better knowledge retention, and thereby contributes to better skills development.

In order to make practical trainings in MTM possible, this article presents an approach for MTM workplace design training in a learning factory. First, the theoretical background of MTM and of action-orientated knowledge transfer in learning factories is presented, followed by the approach, which was developed in the learning factory of the Stellenbosch University in South Africa.

2. MTM for workplace design

MTM is a system of predetermined times and is used for the design of working processes. Therefore, manual tasks are analysed, described, structured and planned by means of defined process modules. These are systematically structured and arranged, in order to visualise influence factors and to design working systems already in the planning phase. For this purpose, the MTM basic system MTM-1 dissects motion sequences in basic movements (Reach, Grasp, Move, Position, and Release). To each basic movement a time value is linked, which depends on defined influence factors (e.g. distances). MTM can be used for several purposes [4]. The main field of application is the time management, for which time values for manual processes are recorded and used for cost calculations, production control or enumeration.

In addition, MTM can be used throughout the entire product creation process (figure 1). Especially for process planners MTM is a useful tool. By a coordinated development of products and correlating processes, high costs for changes in late phases of the product creation process can be avoided. For this purpose, MTM can contribute with the module ProKon (production-suited construction). During the development and design phase of a production system, MTM can support with the analysis of the correlating processes. By determining influence factors, potentials for optimisation can be recognised early. During the operating phase of a production system, this optimisation can be used within a continuous improvement process (CIP).

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